AMERICAN HAND BOOK OF THE DAGUERREOTYPE



S. D. HUMPHREY



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AMERICAN

HAND BOOK

OF THE

DAGUERREOTYPE:

GIVING

THE MOST APPROVED AND CONVENIENT

METHODS FOR PREPARING THE CHEMICALS, AND THE COMBINATIONS USED IN THE ART:

CONTAINING THE

DAGUERREOTYPE, ELECTROTYPE,

AND VARIOUS OTHER PROCESSES EMPLOYED IN TAKING

HELIOGRAPHIC IMPRESSIONS.

BY S. D. HUMPHREY.

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PREFACE.

There is not an Amateur or Practical Daguerreotypist who has not felt the want of a Manual—Hand-Book, giving concise and reliable information for the Processes and Preparations of the Agents employed in his Practice.

This want has induced the Editor to present the Present Volume. His endeavors have been to point out the readiest and most approved Methods of Operation, and condense in its pages as much practical information as its limits will admit. An extended Preface is unnecessary, since the aim and scope of this work is sufficiently indicated by the Title Page.

☞ In compiling this Volume, the Editor has referred to Silliman's, Regnault's, Stockhardt's and Noad's works on Chemistry, and in the practical department to Humphrey's Journal, a work devoted solely to Heliographic Science and Art.

S. D. HUMPHREY.

New York, 1853.

AMERICAN

HAND BOOK

OF THE

DAGUERREOTYPE.

BROMINE.

An article so extensively used in the practice of the Daguerreotypic art as Bromine, is deserving of especial attention,and accordingly every person should endeavor to make himself familiar with its properties and applications.

1. *History.*—This element was discovered in 1826 by M. Balard, in the mother-liquor, or residue of the evaporation of sea-water. It is named from its offensive odor, (*bromos*, bad odor.) In nature it is found in sea-water combined with alkaline bases, and in the waters of many saline springs and inland seas. The salt springs of Ohio abound in the compounds of bromine, and it is found in the waters of the Dead Sea. The only use which

has been made of bromine in the arts is in the practice of photography. It is also used in medicine. In a chemical point of view it is very interesting, from its similarity in properties, and the parallelism of its compounds to chlorine and iodine.

Dr. D. Alter, of Freeport, Pa., is the only American manufacturer, and furnishes all of the "American Bromine." Yet we understand much purporting to be of German manufacture is prepared from that made in Freeport. This is done by individuals in this city, who get well paid for the deception.

For the successful application of bromine as an accelerating agent, we are indebted to Mr. John Goddard of London, who at the time was associated with Mr. John Johnson, now a resident of this city.

2. *Preparation.*—The mother-liquor containing bromides is treated with a current of chlorine gas, which decomposes these salts, setting the bromine free, which at once colors the liquid to a reddish-brown color. Ether is added and shaken with the liquid, until all the bromine is taken up by the ether, which acquires a fine red color and separates from the saline liquid. Solution of caustic potash is then added to the ethereal solution, forming bromide of potassium and bromate of potash. This solution is evaporated to dryness, and the salts being collected are heated

in a glass retort with sulphuric acid and a little oxyde of manganese. The bromine is distilled, and is condensed in a cooled receiver, into a red fluid.

3. *Properties.—Bromine* some what resembles chlorine in its odor, but is more offensive At common temperatures it is a very volatile liquid, of a deep red color, and with a specific gravity of 3, being one of the heaviest fluids known. Sulphuric acid floats on its surface, and is used to prevent its escape. At zero it freezes into a brittle solid. A few drops in a large flask will fill the whole vessel when slightly warmed, with blood-red vapors, which have a density of nearly 6.00, air being one. It is a non-conductor of electricity, and suffers no change of properties from heat, or any other of the imponderable agents. It dissolves slightly in water, forming a bleaching solution.

4. *Chloride of Bromine.*—This as an accelerating agent is by many considered superior to the other Bromide combinations. It can be readily prepared by passing a current of chlorine through a vessel containing bromine. A mixture of two parts muriatic acid and one of black oxide of manganese, should be put into a flask having a bent tube to conduct the chlorine vapor into the bromine in another vessel. This last vessel should also be supplied with a bent tube for conducting the combined vapors with a third vessel or recei-

ver. On the application of the heat from a spirit-lamp to the bottom of the flask, a current of chlorine gas will be disengaged, and pass into the bromine when it readily combines, and gives off a vapor, which, when condensed in the third vessel forms a volatile yellowish-red fluid. It is best, even at ordinary temperature, to place the receiver in an ice-bath. For manner of using, see farther on, under head of *Accelerators*.

5. *Bromides.*—A bromide treated with oil of vitriol, disengages chlorohyadic acid ; but vapors of bromine are constantly disengaged, at the same time imparting a brown color to the gas. If the bromide be treated with a mixture of sulphuric acid and peroxide of manganese, bromine only is disengaged. A solution of a bromide gives, with nitrate of silver, a light yellowish white precipitate of bromide of silver, which is insoluble in an excess of acid, and readily dissolves in ammonia. The precipitated bromide is colored by light like the chloride, but is immediately tinged brown, while the chloride assumes at first a violet hue. The bromides, in solution, are readily decomposed and chloride being set free, colors the liquid brown.

In the whole range of heliographic chemicals there is probably not another collection less understood and being so productive of interesting investigation as the bromides.

6. *Bromide of Iodine.*—M. de Valicours furnishes us with the best method for preparing this mixture:

"Into a bottle of the capacity of about two ounces, pour thirty or forty drops of bromine, the precise quantity not being of importance. Then add, grain by grain, as much iodine as the bromine will dissolve till quite saturated. This point is ascertained when some grains of the iodine remain undissolved. They may remain in the bottle, as they will not interfere with the success of the preparation.

"The bromide of iodine thus prepared, from its occupying so small a space, can very easily be carried, but in this state it is much too concentrated to be used. When it is to be employed, pour a small quantity, say fifteen drops, by means of a dropping-tube, into a bottle containing about half an ounce of filtered river water. It will easily be understood that the bromide of iodine can be used with a greater or less quantity of water without altering the proportion which exists between the bromine and iodine."

This article forms a very good dry accelerator, and is by some persons thought superior to all others, as it works with great uniformity, and is less liable to *scum* the plate in coating at high temperatures, or when the thermometer indicates a heat above 60°.

7. *Bromide of Potassium*—Is prepared by mixing bromine and a solution of pure potass to-

gether, and evaporating to dryness; it crystalizes in small cubes, and dissolves readily in water. This agent is extensively employed in the paper and glass processes.

8. *Bromide of Lime.* This is the principal accelerator used in the American practice, and is the best of all dry combinations at present employed. There are many reasons why the *dry* is advantageous; these are too familiar to repeat.

"The bromide of lime may be produced by allowing bromine vapor to act upon hydrate of lime for some hours. The most convenient method of doing this is to place some of the hydrate at the bottom of a flask, and then put some bromine into a glass capsule supported a little above the lime. As heat is developed during the combination, it is better to place the lower part of the flask in water at the temperature of about 50° Fah.; the lime gradually assumes a beautiful scarlet color, and acquires an appearance very similar to that of the red iodide of mercury. The chloro-iodide of lime may be formed in the same manner; it has a deep brown color. Both these compounds, when the vapor arising from them is not too intense, have an odor analogous to that of bleaching powder, and quite distinguishable from chlorine, bromine, or iodine alone."

Farther on, we give, in connection with accelerators, a process we adopt, which is far less tedious and equally reliable. (See §57, 58.)

9. *Bromide of Silver*—May be formed by pouring an alkaline bromide into a solution of nitrate of silver, in the shape of a white, slightly-yellowish precipitate, which is insoluble in water and nitric acid, but readily dissolves in ammonia and the alkaline hyposulphites. Chlorine easily decomposes bromide of silver, and transforms it into chloride.

Mr. Hunt remarks upon this subject:

"In many of the works on chemistry, it is stated that the chloride is the most sensitive to light of all the salts of silver; and, when they are exposed in a perfectly formed and pure state to solar influence, it will be found that this is nearly correct. Modern discovery has, however, shown that these salts may exist in peculiar conditions, in which the affinities are so delicately balanced as to be disturbed by the faintest gleam; and it is singular that, as it regards the chloride, iodide, and bromide of silver, when in this condition, the order of sensibility is reversed, and the most decided action is evident on the bromide before the eye can detect any change in the chloride.

"The slight additional expense of the bromides is not worthy of consideration, particularly as their use may be confined to papers for the camera obscura, the pictures on which are of course of the negative character, and the positive photographs can be formed by transfer on the chloridated papers of a highly sensitive kind.

"It will be found that the bromide and iodide

are much alike in the singular want of sensibility which they sometimes exhibit under the circumstances already alluded to, which are not easy of explanation.



"If a paper first washed with a solution of nitrate of silver has bromide of potassium applied to it in different proportions, say 20 grains, 15 grains and 10 grains each, in two drachms of water, and, when dry, be again washed over with the silver solution, it will be found, unless, as is occasionally the case, some organic combination interferes, that the order of sensitiveness will begin with the weakest solution, the strongest being the least influenced by light. The different degrees of darkness induced are fairly represented in the margin. As the different bromides give to photographic paper varieties which much resemble those enumerated under the muriates, I have thought it unnecessary to give an account of any of them. The paper prepared with the bromide of potassium is the kind I have adopted, after having tried upwards of two hundred combinations of silver with the other bromides.

"To prepare a highly sensitive paper of this kind, select some sheets of very superior glazed post, and wash it on one side only with bromide of potassium—forty grains to one ounce of dis-

tilled water, over which, when dry, pass a solution of one hundred grains of nitrate of silver in the same quantity of water. The paper must be dried as quickly as possible without exposing it to too much heat; then again washed with the silver solution, and, when dry, carefully preserved for use.

"It will be perceived that I adopt a slightly different manipulation from that recommended by Mr. Talbot. Instead of washing the paper with the solution of silver first, and applying the bromide or the muriate over this, and then the silver wash again, I use the alkaline salt first, and apply the metalic washes one on the other. I have been induced to this from observing that the photographic preparation penetrates less deeply into the paper than when laid on as originally prescribed, and, consequently, the sensibility of it is increased. It will be found that an addition of about one-twelfth of spirits of wine to the solution of silver will much increase the blackness of the paper when solarized; and I think we may safely say that the sensibility is also improved by it—at all events it is not impaired.

"M. Biot has expressed his opinion, that it is not possible to find any substance more sensitive to light than the bromide of silver. This is true to a certain extent, but in combination with deoxidizing agents, other preparations will be named which have a decided superiority over the pure bromide of silver."

Some recent experiments with the bromide of silver have induced us to publish Mr. Hunt's remarks in full, and should we carry out our design of publishing a practical work upon the *process* of the daguerreotype, we shall point out experiments.

10. *Bromide of Gold*—Is readily prepared by adding a little bromide to the brown gold of the assayers, and allowing it to remain sometime under water, or assisting its action by a gentle heat. It forms a salt of a bright crimson color, but in its general properties is precisely similar to the chloride used in gilding.

11. *Bromide of Magnesia*—Is prepared in the same manner as bromide of lime. (§8.)

This mixture is particularly adapted for hot climates, and is used in this country by some few who regard its use as a valuable secret.

12. *Bromide of Starch.*—This preparation is much used, but not alone. It is combined with lime by putting about one part in measure of starch to four of lime. It is prepared by adding bromine to *finely pulverized starch*, in the same manner as bromide of lime. (See *Accelerators.*)

13. *Experiments with Bromine.*—Place in a *very* flaring wine glass a few drops (say ten) of bromine, then place a small piece of phosphorus

about *one-twentieth of an inch* in diameter. Place the latter on the end of a stick from five to ten feet in length. So place it that the phosphorus can be dropped into the glass, and in an instant combustion giving a loud report will be the result.

b. Expose a daguerreotype plate to the vapor of bromine, it assumes a leaden-gray color, which, blackens by light very readily. Exposing this to mercury will not produce any decided action upon the lights. Immerse it in the solution of the muriate of soda, and the parts unacted upon by light becomes a jet black, while the parts on which the light has acted will be dissolved off, leaving a clean coating of silver. This will be a most decided black picture on a white ground.

c. Expose an impressioned plate, that has been sufficient time in the camera to become solarized to the vapors of bromine, and the impression will be fully developed and exhibit no signs of solarization. The exposure over the bromine *must be very brief.* Chlorine or iodine will produce the same result. The latter is preferable.

Again, should the impressioned plate be exposed too long over the vapor of bromine, the impression would be rendered wholly insensitive to the mercurial vapor. Hence this method is resorted to for restoring the sensibility of the plate when there is reason to believe that the impression would not be a desirable one; as, for example, if a likeness of a child be wanted,

and it had moved before the plate had been sufficiently long exposed in the camera, the plate may be restored to its original sensitiveness by re-coating over bromine, as above, thus saving the time and labor of re-preparing the plate for the chemicals.

d. If by accident, (we would not advise a trial to any extent of this,) you should inhale a quantity of the vapor of bromine, immediately inhale thevap or of aqua ammonia, as this neutralizes the dangerous effect of the bromine vapor. Every operator should be provided with a bottle of ammonia, as a little sprinkled about the chemical room soon disinfects it of all iodine or bromine vapor, and also tends to facilitate the operation in the camera.

It may be of interest to state in this place the powerful effect of bromine on animal matter.---This being the only instance in our knowledge, we present it.

A gentlemen in the employment of W. & W. H. Lewis, the well known stock dealers in this city, having some difficulty befall him, he decided on taking his own life. To accomplish this he took one ounce of pure bromine. This was about six o'clock, A. M. At seven he was found by one of the Messrs. Lewis in a state of insensibility. The fumes of bromine at once led Mr. L. to the cause. A physician was called and ammonia was administered. The effect was only to bring back the feelings of the dying man, who suffered the

most excruciating pain, until twelve M. when he became benumbed, the bowels and stomach presenting a saffron color. At one he died, and in one hour more his bowels were completely decomposed. The body was wound in a cloth in order to lift it. It would be a blessing to any one, if by accident or otherwise he should swallow a half ounce of bromine, to make no effort to save him. Antidotes there are none, if ten minutes should elapse.

14. *History of Iodine.*—This is one of the simple chemical bodies which was discovered in 1812 by M. Courtois, of Paris, a manufacturer of saltpetre, who found it in the mother-water of that salt. Its properties were first studied into by M. Gay Lussac. It partakes much of the nature of chlorine and bromine. Its affinity for other substances is so powerful as to prevent it from existing in an isolated state. It occurs combined with potassium and sodium in many mineral waters, such as the brine spring of Ashby-de-la-Zouche, and other strongly saline springs.—This combination exists sparingly in sea-water, abundantly in many species of *fucas* or sea-weed, and in the kelp made from them. It is an ingredient in the Salt Licks, saline, and brine springs of this country, especially of those in the valley of the Mississippi. It is sparingly found in fresh-water plants, as well also in coal, and in combination with numerous other bodies.

Fermented liquors contain iodine ; wine, cider, and perry are more ioduretted than the average of fresh waters. Milk is richer in iodine than wine : independently of the soil, with which it varies, the proportion of iodine in milk is in the

inverse ratio of the abundance of that secretion. Eggs (not the shell) contain much iodine. A fowl's egg weighing 50 gr. contains more iodine than a quart of cow's milk. Iodine exists in arable land. It is abundant in sulphur, iron and manganese ores, and sulphuret of mercury : but rare in gypsum, chalk, calcareous and silicious earths. Any attempt to extract iodine economically should be made with the plants of the ferro-ioduretted fresh waters. Most of the bodies regarded by therapeutists as pectoral and anti-scrofulous are rich in iodine.

It is probably to the application of this body that we owe the discovery of the daguerreotype. There is no record of the precise date when Daguerre commenced experimenting with iodine, but by the published correspondence between him and M. Neipce his partner, it was previous to 1833. There is no doubt however, that the first successful application was made in 1838, as the discovery was reported to the world early in January, 1839.

15. *Preparation.*—Iodine is mostly prepared from *kelp*, or the half vitrified ashes of sea-weed, prepared by the inhabitants of the western islands, and the northern shores of Scotland and Ireland. It is treated with water, which washes out all the soluble salts, and the filtered solution is evaporated until nearly all the carbonate of soda and other saline matters have crystalized

out. The remaining liquor, which contains the iodine, is mixed with successive portions of sulphuric acid in a leaden retort, and after standing some days to allow the sulphureted hydrogen, &c., to escape, peroxyde of manganese is added, and the whole gently heated. Iodine distils over in a purple vapor, and is condensed in a receiver, or in a series of two-necked globes.

16. *Properties.*—Iodine is solid at the ordinary temperature, presenting the appearance of dark-gray or purple spangles, posessing a high degree of metalic lustre. It somewhat resembles plumbago, with which it is sometime diluted, particularly when it is fine. Operators should endeavor to secure the larger crystals. It melts at 224.6°, forming a brown or nearly black liquid. It boils at about 356°, and emits a very deep violet colored vapor. It gives off a very appreciable vapor, sufficient for all purposes of forming the iodide of silver on the daguerreotype plate, at a temperature of 45° or even lower. Iodine crystalizes readily. Every operator has found upon the side of the jar in his coating-box, perfectly regular crystals, deposited there by sublimation.

Water dissolves but a small proportion of iodine, requiring 7000 parts of water to dissolve one of iodine, or one grain to the gallon of water. Alcohol and ether dissolve it freely, as does also a solution of nitrate or hydrochlorate of ammonia and of iodides.

The density of solid iodine is 4.95; that of its vapor 8.716. It greatly resembles chlorine and bromine in its combinations, but its affinities are weaker. It does not destroy the majority of organic substances, and vegetable colors generally resist its action. It combines with several organic substances, imparting to them peculiar colors. It colors the skin brown, but the stain soon disappears.

17. *Chloride of Iodine*—Is formed by passing chlorine into a bottle containing some iodine. This can be readily done by pouring one ounce and a half of muriatic acid upon a quarter of an ounce of powdered black oxide of manganese, and heat it gradually in a flask, to which is adapted a bent glass tube. This tube must connect with the bottle containing the iodine, and the yellowish-green gas disengaged will readily combine with the iodine, forming a deep red liquid, and the operation is complete. The use of chloride of iodine will be referred to in connection with the *Accelerators*.

18. *Iodides*.—The iodide treated with the oil of vitriol, instantly produces a considerable deposit of iodine; and if the mixture be heated, intense violent vapors are disengaged. The reaction is due to the decomposition of oil of vitriol by iodohydric acid, water and sulphurous acid being formed, and iodine set free. The iodides

in solutions are decomposed by chlorine, iodine being precipitated, the smallest quantity of which in solution is instantly detected by its imparting to starch an intensely blue color.

19. *Iodide of Potassium.**—This compound is easily made in the following manner: Subject to a moderate heat a mixture of 100 parts of iodine, 75 of carbonate of potash, 30 of iron filings, and 120 parts of water. This mass must be thoroughly dried and then heated to redness; the resulting reddish powder is to be washed with water, and the solution obtained filtered, and evaporated to dryness. It is found that 100 parts of iodide yield 135 parts of very white, but slightly alkaline, iodide of potassium.

Experiment.—On projecting dry pulverized iodide of potassium into fused anhydrous phosphoric acid, a violent disengagement of iodine takes place, attended by a transient ignition; fused hydrate of phosphoric acid liberates iodine abundantly from iodide of potassium; this re-action is accompanied by the phenomenon of flame and the formation of a considerable quantity of hydriodic acid.

20. *Iodide of Mercury.*—For the preparation

* We shall present the preparation of only a few Iodides, and such as are more intimately connected with the Daguerreotype.

of iodide of Mercury, Dublanc recommends to cover 100 grms. of mercury with 1 kilogrm. of alcohol, to add 124 grms. of iodine gradually in portions of ten grms., and agitating between each fresh addition, until the alcohol becomes colorless again. After the addition of the last 4 grms. the alcohol remains colored, the whole of the mercury having become converted into iodide. The resulting preparation is washed with alcohol; it is crystaline and of a hyacynth color.

21. *Iodide of Silver.*—This compound is formed upon every plate upon which a Daguerreotype is produced. The vapor of iodine coming in contact with the silver surface, forms an iodide which is peculiarly sensitive to light. The various colors produced are owing to the thickness of the coating, and the maximum sensibility of the coating, as generally adopted, is when it assumes a deep yellow, or slightly tinged with rose color.

This compound is largely employed in most photographic processes on paper, and may be easily prepared by the following formula: By adding iodide of potassium (§19) to a solution of nitrate of silver, a yellowish-white precipitate of iodide of silver is obtained, which is insoluble in water, slightly soluble in nitric acid, and soluble in a small degree in ammonia, which properties seem easily to distinguish it from the chloride and bromide of silver. Chlorine decomposes it and sets the iodine free, and chlorohydric acid converts it

into a chloride. It fuses below a red heat. Although the effect of light on the iodide is less rapid than on the chloride, the former sooner turning black, assuming a brown tinge; but when in connection with gallic acid and the ferrocyanate of potash, it forms two of the most sensitive processes on paper.

Iodide of silver dissolves easily in a solution of iodide of potassium, and the liquid deposits in evaporation crystals of a double iodide.

22. *Iodide of Gold.*—If a solution of potassium (§19) be added to a solution of chloride of gold, a precipitate of iodide of gold takes place, soluble in an excess of the precipitate. A little free potash should be added to combine with any iodide that may chance to be set free by the chloride of gold.

23. *Iodide of Lime* is prepared by adding iodine to hydrate of lime, (which will be referred to farther on,) until the mixture assumes a light yellow shade, when wanted for combinations with accelerators, or to a dark brown when employed for the first coating. This latter mixture has been sold in our market under the name of "Iodide of Brome."

24. *Iodide of Bromine.*—(See §6.)

25. *Experiments with Iodine.*—Place a plate

which has been exposed in the camera over the vapor of iodine for a very brief period, and it will present the appearance of the impression having been solarized. (See §13.)

b Upon a Daguerreotype plate, from which an impression has been effaced by rubbing or otherwise, the picture may be made to reappear by merely coating it over with iodine.

c Place in a vessel a little water, into which put the smallest possible quantity of free iodine and add a little starch, and the liquid will instantly assume a blue color. Advantage is taken of this fact in the laboratory to detect the presence of iodine in liquids. The starch should be dissolved in boiling water and allowed to cool. There are numerous other interesting experiments that can be performed by the aid of iodine, but it is unnecessary here to consume more space.

History.—The Swedish chemist, Scheele, in 1774, while examining the action of hydrochloric acid on peroxyde of manganese, first noticed this element. He called it *dephlogisticated muriatic acid.* It was afterwards, by the French nomenclaturists, termed oxygenated muriatic acid, conceiving it to be a compound of oxygen and muriatic acid. This view of its notice was corrected by Sir H. Davy, (in 1809,) who gave it the present name. In 1840–41, this gas was employed for accelerating the operation of light upon the iodized Daguerreotype plate. John Goddard, Wolcott & Johnson, Claudet, Draper, Morse and others, were among the first made acquainted with its use. Count Rumford, Ritter, Scheele, Seebert and others, experimented with chlorine in regard to its effect when exposed to the action of light in combination with silver. In 1845, M. Edward Becqueral announced that he had "been successful in obtaining, by the agency of solar radiations, distinct impressions of the colors of nature." (His process is given in another place.)

On the 4th of March, 1851, M. Niepce, St. Victor, a former partner with DAGUERRE, announced that he had produced "all the colors by using a bath of bichloride of copper, and that a similar

phenomenon occurs with all salts of copper, mixed with chlorine." Neipce's process is referred to in another place.

26. *Preparation.*—This is easily accomplished by putting about two parts of hydrochloric (muriatic) acid, on one of powdered black oxide of manganese, and heating it gradually in a flask or retort, to which may be adapted a bent glass tube. A yellowish-green gas is disengaged, which being conducted through the glass tube to the bottom of a bottle, can readily be collected, being much heavier than the air, displaces it completely and the bottle is filled, (which can be seen by the green color;) a greased stopper is tightly fitted to it, and another bottle may be substituted.

In all experiments with chlorine, care should be taken not to inhale the gas!

27. *Properties.*—Chlorine is a greenish-yellow gas, (whence its name, from *chloros*, green,) with a powerful and suffocating odor, and is wholly irrespirable. Even when much diluted with air, it produces the most annoying irritation of the throat, with stricture of the chest and a severe cough, which continues for hours, with the discharge of much thick mucus. The attempt to breathe the undiluted gas would be fatal; yet, in a very small quantity, and dissolved in water, it is used with benefit by patients suffering under pulmonary consumption.

Under a pressure of about four atmospheres it

becomes a limpid fluid of a fine yellow color, which does not freeze at zero, and is not a conductor of electricity. It immediately returns to the gaseous state with effervescence on removing the pressure.

Water recently boiled will absorb, if cold, about twice its bulk of chlorine gas, acquiring its color and characteristic properties. The moist gas exposed to a cold of 32° yields beautiful yellow crystals, which are a definite compound of one equivalent of chlorine and ten of water. If these crystals are hermetically sealed up in a glass tube, they will, on melting, exert such a pressure as to liquify a portion of the gas, which is distinctly seen as a yellow fluid, not miscible with the water which is present. Chlorine is one of the heaviest of the gases, its density being 2.47, and 100 cubic inches weighing 76.5 grains.

28. *Chlorine Water.*—This combination, which is used in conducting M. Neipce's process, can be readily prepared by conducting the gas (§26) into a bottle containing distilled water. One part water dissolves two parts of chlorine.

29. *Chlorides.* — The metalic chlorides are nearly all soluble in water; that of silver and protochloride of mercury being the only exceptions. A metalic chloride, treated with oil of vitriol, disengages chlorohydric acid. Heated with a mixture of peroxide of manganese and sulphuric acid, chlorine is given off, which is easily recognized by its odor and other physical properties.

The chlorides dissolve in water; give with nitrate of silver, a white precipitate, even in highly diluted solutions, becoming violet-colored and finally black when exposed to the light. The rapidity of the change of color is proportioned to the intensity of the light. It is insoluble in nitric acid, but readily soluble in ammonia; it fuses without decomposition, forming, when cold, a tough, horny mass, and is reduced by hydrogen and by fusion with carbonate of soda, or with resin.

30. *Chloride of Bromine.* (See §4.)

31. *Chloride of Iodine.* (See §17.)

32. *Chloride of Potassium*—(or *Muriate of Potassa.*)—Dissolve half an ounce of carbonate of potassa in water, and neutralize with muriatic acid. Upon concentrating the solutions, cubic crystals will be obtained, having a taste similar to common salt. They consist of potassium and chlorine, and when dissolved in water they may be regarded as muriate of potassa.

33. *Chloride of Lime.* Mix half an ounce of slacked lime (hydrate of lime) with six ounces of water, and conduct into this milk of lime, with frequent agitation, as much chlorine gas (§26) as will evolve from two ounces of muriatic acid and half an ounce of black oxyde of manganese. The liquid clarifies by standing; may be regarded as a

solution of *chloride of lime*, and must be protected from the air and light. It may also be made without putting in the water with the hydrate of lime, by merely passing the chlorine into the hydrate of lime. This last is by some used in prepartions for accelerating the operation of taking Daguerreotypes, but when used for this purpose it is in small quantities.

34. *Chloride of Calcium.*—To one part of water add two parts of muriatic acid, and add pieces of common chalk until effervescence ceases; then filter through cotton cloth and evaporate it by placing it in an earthen or porcelain dish, over a slow fire, to the consistency of a syrup. When cooling, large prismatic crystals of chloride of calcium are formed. These must be quickly dried by pressing between folds of blotting paper and kept carefully excluded from the air, as it readily attracts hydrogen. For most daguerreotype purposes, the syrup may be at once evaporated to dryness. This is frequently placed in the iodine coating box for the purpose of keeping the atmosphere dry. It is so easily made that every operator can provide himself with it in a short time, and at little expense.

35. *Chloride of Gold*—Is prepared by dissolving gold in aqua regia, a composition of one part of nitric to two parts of muriatic acid. Gold foil is the best for our purposes; coin, however, answers, in most cases, for the daguerreotype op-

erator, as the alloy, being so slight, is not noticed in the gilding process. When the latter is used, it will facilitate the operation to beat it out, forming a thin sheet, and then cutting in small strips. Where purity is required, foil is better. The gold is placed in three or four times its own weight of the above acids. For this purpose, an evaporating dish is best (a common saucer will do); a *moderate* heat may be applied to favor the action. The mixture should be stirred often with a glass rod; care should be observed not to apply too much heat, for at a temperature of about 300° the chlorine would be expelled and leave a metalic precipitate, which would require re-dissolving. Acid may at any time be added if necessary to dissolve the gold, but it is advisable to add as little excess as possible, as it would require more time to evaporate. After all the gold has dissolved, and the liquid assumes a deep red color, the solution should be allowed to cool, being stirred nearly all the time. This salt is of a reddish-brown color. It is rarely we find in our market good chloride of gold, as *common salt* is used for the bulk; and when the bottles are labeled "15 grains," "20 grains," nine-tenths do not in reality contain exceeding *five grains* of chloride of gold. The salt is mixed with the above solution when it is cooling, and gives bright yellow crystals, which some of our uninformed operators conceive to be the best quality. If those who have been using the common chloride of gold of our market will once order *pure chloride of*

gold from Edward N. Kent, of this city, they will be surprised with the great difference.

36. *Chloride of Silver.*—(Oxide of Silver.)—Take any quantity of silver coin or other silver, roll or hammer it thin; cut in small pieces. This in order to save time. Put the silver in a glass or earthen vessel (Florence flask is best); pour in nitric acid and water, about three parts of the former to one of the latter. The operation of cutting up the silver may be facilitated by applying a gentle heat. This blue solution consists of oxide of silver and oxide of copper, both combined with nitric acid. Should the operator wish a pure solution of silver, which, however, is not always used, he may obtain it in the following manner:

To separate the two metals contained in the above solution from each other, put some bright copper coins into the solution and set it aside in a warm place for three or four days, occasionally giving it a circular motion. The separated laminæ are *pure silver*, which are to be digested with ammonia until it ceases to be colored blue. The silver, after being washed and dried, is again dissolved in nitric acid, and the liquid, diluted with water, is kept as *solution of silver*.

Either of the above solutions (the one of oxide of silver and copper, and the pure silver solution) may be prepared for use by putting them in a bottle, with a quantity of water, and adding common fine salt, you obtain a white curdy pre-

cipitate of *chloride of silver*. No matter how much salt is used, provided enough be added to throw down all the chloride of silver. This solution should be well agitated and then allowed to stand for a few minutes; thus the white precipitate is in the bottom of the bottle. When the water has become clear, pour it off with care, leaving the sediment behind; then add a fresh quantity of clean water, shake, let settle, and pour off as before. Repeat the same for several times, and the excess of salt will disappear, leaving the white precipitate, which may be drained of the water and dried in the dark, and kept free from light and air.

37. *Cyanide of Potassium.*—This important article is worthy the undivided attention of every Daguerreotypist. We here give Mr. Smee's process for its preparation. This is from that author's work entitled, "*Electro Metallurgy*," American edition:

"The cyanide of potassium, so often alluded to while treating of the metallo-cyanides, may be formed in several ways. It may be obtained by heating to a dull redness the yellow ferrocyanate of potash, in a covered vessel, filtering and rapidly evaporating it. The objection to this method, however, is, that without great care the whole of the ferrocyanate is not decomposed, a circumstance which much reduces its value for electro-metallurgy. By boiling, however, the ignited residue with spirits of wine, this difficulty is said to be overcome, as the ferrocyanate is absolutely insoluble in that menstruum, while the cyanuret, at that heat, freely dissolves, and is as easily re-deposited on cooling.

"There is, however, a much better process by which this salt may be formed, viz: by simply transmitting hydrocyanic acid through potassium. Although the modes of making this acid are very numerous, there is but one which is likely to be

employed on a very large scale, and that is its formation from the yellow ferrocyanate by means of sulphuric acid. This process is performed as follows: Any given weight of the yellow salt is taken and dissolved in about five times its weight of water; this is placed in a retort, or some such analogous vessel, to which is then added a quantity of strong sulphuric acid, twice the weight of the salt, and diluted with three or four times its quantity of water. A pipe is carried from the neck of the retort to the receiving bottle, which should be kept as cool as possible. For small operations, those invaluable vessels, Florence flasks, answer well: a bent tube being connected at one end to its mouth, the other passing into the second vessel; heat should be cautiously applied by means of an Argand lamp, a little vessel of sand being placed under the flask, which helps the acid to decompose the salt. Prussic acid is then generated and passes through the tube to the recipient vessel, which is to be charged with liquor potassæ. When the potash is saturated, the operation is completed. The Germans recommend a strong alcoholic solution of potassa to be used in the second vessel, for in this case, the hydrocyanic or prussic acid combines with the potassa, forming a hydrocyanate of potassa, or, the water being abstracted, the cyanuret of potassium, which spontaneously precipitates, on the saturation of the fluid, the cyanuret being insoluble in strong alcohol. The ferrocyanate of potash may be considered as containing three equiv-

alents of hydrocyanic acid, two of potash and one of iron; but, unfortunately, we can only obtain half the acid from the salt, owing to the formation of a compound during its decomposition which resists the action of the acid. The decomposition of this salt taking 2 equivalents or 426 grains (to avoid fractions), would afford 3 equivalents or 81 grains of hydrocyanic, or prussic acid, capable of forming 198 grains of cyanuret of potassium, while in the retort there would remain 384 grains or 3 equivalents of bisulphate of potash, and 1 equivalent or 174 grains of a peculiar compound, said to contain 3 equivalents of cyanogen, 1 of potassium and one of iron (Pereira). It is manifest that, but for this latter compound, we might double the quantity of hydrocyanic acid from the yellow salt. The decomposition just described is the one usually received; but too much reliance must not be placed on its accuracy, for the analysis of the several compounds is too difficult for the results to be fully admitted. The residue left in the retort speedily turns to one of the blues, identical with, or allied to, Prussian blue. This is at best a disagreeable process to conduct, for the hydrocyanic acid formed adheres so strongly to the glass, that, instead of being freely given off, bubbles are evolved svddenly with such explosive violence as occasionally to crack the vessel. This may be remedied as far as is possible by the insertion of plenty of waste pieces of platinum—if platinized, so much the better, as that

facilitates the escape of the gas. The heat should be applied to every part of the vessel, and the flame should not be allowed to play upon one single part alone. Large commercial operations are performed in green glass or stone-ware retorts.

"Now for one word of advice to the tyro: Remember that you are working with prussic acid; therefore, never conduct the process in a room, the fumes being quite as poisonous as the solution of the acid itself; moreover, have always a bottle of ammonia or chlorine by your side, that should you have chanced to inhale more than is pleasant, it will be instantly at hand to counteract any bad effects. It is stated by Pereira, that a little sulphuric acid or hydroferrocyanic acid passes to the outer vessel, but probably the amount would be of no consequence for electro-metallurgy, otherwise, it might be as well to use a Woulfe's apparatus, and discard the salt formed in the first vessel. To the large manufacturer it may be worth considering whether some other metallo-cyanuret, formed in a similar manner to the ferrocyanuret, might not be more advantageously employed, because the residue of the process last described contains a large quantity of cyanogen which the acid is unable to set free.

"There are other modes of procuring prussic acid, besides the one which has been so tediously described; but these are found to be more expensive. The only one which I shall now notice is the process by which it is obtained from bicyanide of mercury. The bicyanide of mercury it-

self is formed when peroxyde of mercury is digested with Prussian blue, the peroxyde of mercury abstracting the whole of the cyanogen from the blue, and leaving the oxydes of iron at the bottom of the vessel. The solution may be evaporated to dryness, and one part of the salt dissolved in six of water; one part of muriatic acid, sp. gr. 1·15, is then added, and the solution distilled, when the whole of the hydrocyanic acid passes over, and by being conducted into a solution of potassa, as in the former process, forms cyanuret of potassium. This process, though easier than the first described, is rather given as a resource under peculiar circumstances than as one to be adopted by the large manufacturer. The expense is the only objection, but in a small quantity this cannot be a consideration.

"In giving this very rough outline of the general mode of forming salts, the minutiæ necessary for chemical work have altogether been avoided, and those parts alone are entered upon which are more immediately necessary for the electro metallurgist to know and practise for himself. This will account for the long description of the cyanuret of potassium, while the preparation of the equally important and even more used acids, the sulphuric, muriatic, &c., commonly found in commerce, are altogether neglected.

"In using solutions of cyanide of potassium, the workman should not immerse his arms into them, otherwise it occasionally happens that the solution produces very troublesome eruptions over the skin."

38. *Hyposulphite of Soda.*—This salt forms one of the important chemicals for the Daguerreotype operator. Its application to this art is of an interesting nature. It is used to dissolve the *sensitive* salt of silver which remains unchanged during the exposure in the camera. It has the property of readily dissolving the chloride, bromide and iodide of silver. It should be pure and free from sulphuret of sodium; should this last be present, it will cause brown spots of sulphurated silver upon the Daguerreotype impression. This annoyance is a great source of complaint from many operators, and ever will be, so long as it is prepared by men who have no reputation to lose, and whose eyes are blinded by the "Almighty Dollar."

A good article may be prepared as follows:

"Mix one pound of finely pulverized carbonate of soda with ten ounces of flour of sulphur, and heat the mixture slowly in a porcelain dish till the sulphur melts. Stir the fused mass, so as to expose all its parts freely to the atmosphere, whereby it passes from the state of a sulphuret, by the absorption of atmospheric oxygen, into that of a sulphite, with the phenomenon of very slight incandescence. Dissolve in water, filter

the solution, and boil it immediately along with flour of sulphur. The filtered concentrated saline liquid will afford, on cooling, a large quantity of pure and beautiful crystals of hyposulphite of soda.

39. *Hyposulphite of Gold.*—This compound salt is by a few considered preferable to the chloride of gold, §35; but our experience has induced us to use the latter, believing we are enabled to produce a more brilliant and warm-toned impression with it. When the hyposulphite of gold is used in gilding, it requires less heat and a longer application, as there is some danger of producing a glossy scum over some parts of the surface of the plate. We prepare this salt as follows:

Dissolve one part chloride of gold and four parts hyposulphite of soda in equal quantities of distilled water: pour the gold into the hyposulphite solution, in the same manner as in mixing the gilding solution; let it stand until it becomes limpid; filter and evaporate to dryness. Re-dissolve and add a few grains of burnt alum.

After standing a few hours, filter and evaporate again. If not sufficiently pure, repeat the crystalization until it is so. For gilding, dissolve in water and use in the same manner as the common gilding solution.

N. B.—The four following mixtures (40, 41,

42 and 43) were employed in Neipce's process in his earliest experiments:

40. *Aqueous Solution of Bichloride of Mercury.*—Eight grains of bichloride of mercury in 10,000 grains of distilled water.

41. *Solution of Cyanide of Mercury.*—A flask of distilled water is saturated with cyanide of mercury, and a certain quantity is decanted, which is diluted with an equal quantity of distilled water.

42. *Acidulated White Oil of Petroleum.*—This oil is acidulated by mixing with it one tenth of pure nitric acid, leaving it for at least 48 hours, occasionally agitating the flask. The oil, which is acidulated, and which then powerfully reddens litmus paper, is decanted. It is also a little colored, but remains very limpid.

43. *Solution of Chloride of Gold and Platinum.*—In order not to multiply the solutions, take the ordinary chloride of gold, used for fixing the impressions, and which is composed of 1 gramme of chloride of gold and 50 grains of hyposulphate of soda, to a quart of distilled water.

With respect to chloride of platinum, 4 grains must be dissolved in 3 quarts of distilled water; these two solutions are mixed in equal quantities.

44. *Acids.*—We shall not go into the preparations of the various acids employed in the Daguerreotype. This would be useless to the operator, as there are few, if any, that it would be advisable to prepare. It is only necessary for the experimenter to be made acquainted with their properties, and this in order to prevent any hap-hazard experiments, which are too common among operators. Any person who may be desirous to try an experiment, should first study the agents he wishes to employ. By so doing much time and money will be saved; while the searcher after new discoveries would rarely become vexed on account of his own ignorance, or be obliged to avail himself of the experience of others in any department of science.

45. *Nitric Acid*—Exists in combination with the bases, potash, soda, lime, magnesia, in both the mineral and vegetable kingdoms, and is never found insoluble. It has the same constituents as common air, but in different proportions. The strongest nitric acid contains in every pound, two and a quarter ounces of water. Pure nitric acid is colorless, with a specific gravity of 1.5, and boiling at 248°. It is a most powerfully oxydizing

agent, and is decomposed with more or less rapidity, by almost all the metals to which it yields a portion of its oxygen.

The nitric acid of commerce, is generally the article used by the Daguerreotypist. This usually contains some chlorine and sulphuric acid. It is obtained by the distillation of saltpetre with sulphuric acid. It is employed in the Daguerreotype process for dissolving silver, §36, preparing chloride or oxide, nitrate of silver, [the former used in galvanizing,] and in combination with muriatic acid for preparing chloride of gold, used in gilding. It is also used by some for preparing the plate, §46.

46. *Acidulated Solution.*—This solution is used for cleaning the surface of the Daguerreotype plate. It has the property of softening the silver, and bringing it to a state in which it is very susceptible of being either oxydized or iodized, hence it contributes in increasing the sensibility of the plate. The proportions are to one drop of acid add from 15 to 20 drops of water, or make the solution about like sharp vinegar to the taste.

47. *Nitro-Muriatic Acid.—Aqua Regia* is a compound menstruum invented by the alchemists for dissolving gold. It is composed of colorless nitric acid (aqua-fortis) and ordinary muriatic acid, the mixture is yellow, and acquires the power of dissolving gold and platinum. These materials are not properly oxydized; it nearly causes their

combination with chlorine, which is in the muriatic acid, §48.

48. *Hydrochloric Acid* (*Muriatic Acid*).—This acid forms a valuable addition to the chemicals employed by the practical Daguerreotypist. This acid is formed by acting upon common salt (which is chloride of sodium) by concentrated sulphuric acid. The water of the acid is decomposed, and its hydrogen combines with the chloride of the salt to form muriatic acid, and this unites with the sulphuric acid to form sulphate of soda; 60 parts of common salt and 49 parts of concentrated sulphuric acid, afford, by this mutual action, 37 parts of muriatic acid and 72 parts of sulphate of soda. The muriatic acid of commerce has usually a yellowish tinge, but when chemically pure it is colorless. The former is commonly contaminated with sulphureous acid, sulphuric acid, chlorine, iron, and sometimes with arsenic.

Muriatic acid, from the fact of the presence of the chlorine, is used in the Daguerreotype process for dissolving gold, and in combination with various accelerators. Its presence can be detected by ammonia. A strip of paper dipped in this and waived to and fro will emit a thick white smoke if the acid vapor be in the atmosphere. The ammonia neutralizes the acid fumes. By reversing the experiment we can determine whether vapor of ammonia be in the air, and also deprive these suffocating and dangerous gases of

their injurious properties, and remove them from the air. Every Daguerreotype operator should be furnished with, at least, a six-ounce bottle of *aqua ammonia*. Its operation is very nearly the same on bromine and iodine vapor.

49. *Hydrofloric Acid* (*Florohydric Acid*).—This acid is used to form some of the most volatile and sensitive compounds employed in the Daguerreotype. It is one of the most dangerous bodies to experiment with: it is volatile and corosive, giving off dense white fumes in the air. It combines with water with great heat. At 32° it condenses into a colorless fluid, with a density 1.069. It is obtained from decomposition of fluor spar by strong sulphuric acid. It readily dissolves the silicia in glass, and consequently cannot be kept in a vessel of that material. It is prepared and kept in lead. It is employed in accelerators on account of its fluorine.

One small drop on the tongue of a dog causes death. The operator who wishes to use it should pour some of the liquid for which he intends it into a graduate, or other vessel, and then add the desired quantity of acid. If by accident any of the spray should fall upon the skin, it should at once be copiously drenched with water.

50. *Sulphuric Acid.*—There are two sorts of this acid: one is an oily, fuming liquid; this is made in Nordhausen, in Saxony, and is commonly called "Nordhausen sulphuric acid," or

oil of vitriol. The other, which is the kind used in connection with the Daguerreotype, is common sulphuric acid. It is somewhat thinner, and when undiluted is not fuming. This acid may be obtained in a solid and dry state, called *anhydrous sulphuric acid.*

The common sulphuric acid is made by burning sulphur, which forms *sulphureous acid.* To convert this into sulphuric acid and gain more oxygen, nitric acid, which is rich in that body, is added. It forms a limpid, colorless fluid, of a specific gravity of 1.8. It boils at 620°; it freezes at 15°. It is acrid and caustic, and intensely acid in all its characters, even when largely diluted.

Its attraction for bases is such that it separates or expels all other acids, more or less perfectly, from their combinations. Its affinity for water is such that it rapidly absorbs it from the atmosphere, and when mixed with water much heat is evolved. It acts energetically upon animal and vegetable substances, and is a poisonous, dangerous substance to get on the skin. It is a powerful oxydizing agent; hence its use in the galvanic battery, for which purpose it is mostly used by the Daguerreotypisi. The fumes of this being so much more offensive than nitric acid, the latter is sometimes used. It is also employed in some of the more sensitive accelerators.

51. *Remarks on the Accelerating Substances Used in the Daguerreotype.*—We have now arrived at a point in this work, where the eye of the Daguerreotype public will intently search for something new. This search will prove in vain, at least so far as regards those who have enjoyed and embraced the opportunities for studying the principles of our art. Every experienced operator has in a degree become familiar with the *mechanical* uses of all the agents employed, while we fear but few understand the properties, and laws governing those properties, which are so indispensible to produce an image impressed upon the silver surface.

There are three substances which form the bases for producing a Daguerreotype: silver, iodine and bromine. Each forms a separate body, which is indispensible to the operator's success, as the art is now practiced in America. With these three, compounds of great variety are formed.

The silver surface is first thoroughly cleaned and freed from all organic matter, then exposed to vapor of iodine, producing an iodide of silver, (a salt, §21.) The plate upon which is this salt, is again exposed to the vapor of bromine, forming a bromo-iodide of silver, a salt also.

As most of the various accelerators are compounds of bromine, with either chlorine or fluorine combination, they partake somewhat of the nature of these latter, giving results which can be detected by the experienced operator. Thus muriatic acid is added for its chlorine, which can generally be detected by the impression produced, being of a light, soft, mellow tone, and in most cases presenting a brilliant black to that colored drapery. Those who wish to experiment with agents for accelerating substances, should first study and well understand the nature of the properties of itself; as well, also, to endeavor to find out what will be the probable changes it will undergo in combination as an accelerator. This should be done before making the experiments. From the foregoing it will be seen that numerous compounds are formed from the same basis, and, consequently, it would be a waste of time and a useless appropriation to devote more of our space than is necessary to give the principal and most reliable combination.

In America, the words "*Quick*" and "*Quick Stuff*," are more generally used for and instead of the more proper names, "Sensitives," or "Accelerators," &c. As it has by use become common, we frequently use it in this work.

52. *Liquid Accelerator*, No. 1.---This mixture was used by us in 1849, and we give it as it appeared in our "System of Photography," published at the above date:

Take pure rain or distilled water, one quart, filter through paper into a ground stopper bottle, and add, for warm weather, one and a half ounce chloride of iodine; or for cold, one ounce; then add one ounce bromine, and shake well. Now, with care not to allow the vapor to escape, add, drop by drop, thirty drops of aqua ammonia, shaking well at each drop. Care must be taken not to add more at a time, as it evolves too much heat. This, mixed, in equal proportions with John Roach's quick, forms an excellent chemical combination. For this purpose, take one and a half ounce of each, to which add ten ounces water, for warm weather, or from six to seven for cold. Pour the whole into a large box, and it will work from two to four months. We are now using (1849) one charged as above which has been in constant use for three months, and works uniformly well. The above is right for half or full size boxes, but half of it would be sufficient for a quarter size box.

Coat to the first shade of rose over iodine, change to a deep rosy red over quick, and back about one tenth the first.

We would not now recommend the addition of "John Roach's quick," as we believe equally good results can be produced without it. This liquid is now used by many, and is very good for taking views.

53. *Lime Water Quick.*—This mixture is more used at present than all the other liquids ever in-

troduced. It produces the most uniform results, giving the fine soft tone so characteristic in pictures produced from accelerators containing chlorine. To one quart of lime water (this can be had of any druggist) add one and a half ounce of pulverized alum, This should be shook at intervals for twenty-four hours; then add one ounce of chloride of iodine and three fourths ounce of bromine. See §54.

54. *Lime Water.*—This is easily prepared by putting lime into water, say a piece of quick lime about the size of an egg into one quart of water. This should be shook occasionally for two or three days and allowed to settle, when the water can be poured off and used as directed in §53.

Use.—To one part of quick add six parts of water; coat to a light yellow over the iodine, to a rose color over the quick, and re-coat about one tenth. The above coating may be increased or diminished, it matters not, so that there is not too much, and the proper proportions are preserved. Some add to the above a small quantity of magnesia, say about a tea-spoonful to the quart of liquid.

55. *Liquid Accelerator*, No. 2.—The following was for a long time used by one of the first houses in the United States, and probably was one of the first liquids ever used. It produces a fine-toned picture, but is not considered as sure as the lime water quick:

Take rain water one quart, add pulverized alum until it is a little sour to the taste, and a small piece, say one half inch square, of magnesia. Filter through paper, and add chloride of iodine one half ounce, bromine sufficient to take it up, which is a little less than half an ounze.

Charge with one of quick to six of water; coat over iodine to a soft yellow, nearly, but not quite, bordering on a rose; over quick to a dark purple, or steel, and back one sixth to one tenth.

56. *Wolcott's American Mixture.---Van Loan Quick.*—This mixture was first formed and used by Wolcott & Johnson, and gained great celebrity for its productions. We have now a bottle hermetically sealed that contains about a half ounce of this mixture, prepared in 1841 by John Johnson, now a resident of this city, and the former partner of Mr. Wolcott. The preparation of this mixture, as furnished by Mr. Johnson himself, is given as follows:

"One part of bromine, eight parts of nitric acid, §45, sixteen parts of muriatic acid, §48, water one hundred parts. This mixture should be allowed to stand for several days; it improves by age.

"*Use.*---A few drops say, 6 to 12, of this mixture should be put into about 6 or 8 ounces of water; it will require frequent replenishing by the addition of a few more drops. The plate should be coated over the dry iodine to a red just bordering on a slate, and then exposed to the mix-

ture only sufficiently long to change the color. If this is not done in less than six seconds it is not strong enough. Re-coat over the iodine full one fourth as long as first coating."

This exceedingly volatile compound is difficult to control from its instability; it is but little used. The impressions successfully produced by this mixture are very brilliant, and possess a pleasing peculiarity.

DRY SENSITIVES.

57. *Hydrate of Lime.*---The operation by which water is combined with lime is called slaking. Take a piece of quick lime, common lime used in mortar, and immerse it in warm water for about fifteen seconds; then place it in an iron or tin vessel. It will soon begin to swell, evolving a great deal of heat and emitting steam, and soon falls into a fine powder, hydrate of lime. This should be well stirred and allowed to cool, and then bottled in order to prevent it from giving off the hydrate and recovering the carbonic acid from the atmosphere. This last is detrimental to its use with bromine, and is one cause of the complaint that "it will not take bromine." The hy-

drate of lime should *not* be dried over a heat, as has been supposed by many, for in that case the hydrogen is expelled and it returns to a carbonate. It is advisable to cool it in a damp place like a ground cellar. Much of the lime in our market will not, except it be quite damp, combine with the bromine. This is owing to impurities. We have, in the last twelve months, slaked and used some four barrels of quick lime in the preparation of accelerators, and find nothing equal to oyster-shell lime, which we use altogether.

58. *Bromide of Lime.*---In preparing large quantities of this, we adopt the following method: Fill a four-quart bottle about two thirds full of hydrate of lime, § 57; pour into this about one or two ounces of bromine; then shake well, add more of the bromine, shake well and let it stand for a few hours, adding sufficient bromine to give it a fine red color. It is better when kept in the large bottles, as it forms a more perfect combination: in other words, it improves by age.

Use.---Coat over the iodine to a rose red, and then over this mixture to a purple or slate; re-coat over the first about *one fourth* as long as first coating.

59. *Gurney's American Compound.*---Of this compound there are two combinations, one for use, when the temperature of the atmosphere is above 65 or 70°, and the other at a lower temperature. The first is called No. 1, the second No. 2.

No. 1 is prepared by placing hydrate of lime in a bottle, same as described in §58, adding to three quarts of the hydrate, one ounce of pulverized burnt alum, as much chloride of lime as can be put on a quarter of a dollar, and from 15 to 30 grains of dry pulverized iodine, or enough to change the color of the hydrate of lime, to the *slightest possible* tinge of yellow. There had better be less, than carry the color to a deeper shade. The object of using the iodine is to form a compound with bromine that is not so volatile as the bromine itself. No matter how little iodine is combined with the bromine the vapors possess their relative proportion; hence, only enough iodine to prevent "flaring," or, as it is often termed, "a scum-coating," is used. The iodine should be thoroughly combined with the lime, which will take about one or two days. Should add bromine the same as in bromide of lime, §58, until the compound assumes a light red color.

No. 2 is prepared in the same manner as No. 1, except the addition of the iodine, which is omitted.

Use.---No. 1. Coat over the iodine to a bright yellow color, then over the compound, No. 1, to red color, re-coat over iodine, about one sixth as long as the time occupied in first coating.

No. 2. Coat over iodine same as above, except re-coat over the iodine about one fourth to one half as long as first coating.

60. *Dry Quick, No. 1.---Bromide of Lime and Starch.*---The following compound forms an ex-

cellent accelerator, and is used by many. It is claimed for this preparation, that it will hold the bromine longer than others where starch is not employed. As regards this claim, we do not think it can be substantiated. Our experience in practice has led us to the conclusion that there is no great difference as respects durability, but there is some little difference as regards the tone of the impressions produced by its use.

To one quart of hydrate of lime add one quart of finely pulverized starch. To this mixture add bromine same as in §58, until it assumes a deep yellow or pink color.

Starch may be added to any of the Dry mixtures.

Use.---Coat over the iodine to a deep yellow, then over this quick to a red color, re-coat about one sixth of the time of first coating.

We will here again remark, that the exact color of the coating is not essential, provided a proper proportion is preserved.

We have never seen it stated, though it be a fact worthy of note, that a proportionate *time* for coating over the iodine and accelerator, will not answer. For example; if a plate exposed to the vapor of iodine be perfectly coated in *sixteen* seconds, and then exposed to an accelerator, (not having iodine in its combination) receives its coating in *four* seconds, it will be found that a proper proportionate coating cannot be preserved by adopting a proportion of time, but on the contrary, the time will diminish; for exposure over

the accelerator, as in the above example, if it be desired to coat the plate with twice as much iodine as in the above example, the time would be, over iodine *thirty-two* seconds, and over the accelerator (to possess a proper proportion) from *six* to *seven* seconds. Hence it is that many inexperienced operators, when wishing to vary their usual manner of coating, fail in producing a favorable result. They coat calculating a proportion of time when they should not.

61. *Dry Quick*, No. 2.—*Bromide of Lime and Magnesia.*—To one quart of hydrate of lime, §57, add one quart of magnesia, and mix them well together; add bromine same as in §58; coat the same as in §60. This combination produces very uniform results, and is worked with much success by beginners.

62. *Chloro-Bromide of Lime.*—To the bromide of lime, §58, add chloride of bromine until the mixture becomes a pale yellow color, resembling sulphur. It should be shook well, and enough of the chloride of bromine added to bring the compound to a deep blood red color.

Use.—Coat over the iodine to a pink color, and then over the above to a red, or just changing the color. It should be remembered that accelerators containing chlorine do not admit of a great change of color of coating on the plate.

63. *Iodide of Starch.*—This mixture can be

employed for coating over in warm weather, and prevent the flashing resulting at high temperatures. It may be used the same as the iodide alone.

To six ounces of finely pulverized starch, add one fourth ounce of dry iodine.

Use.—Same as the dry iodine alone.

The same combination may be made with lime, magnesia and other substances.

64. *Concentrated Solution of Iodine for Fist Coating.*—It may appear strange to some of our old operators that an aqueous solution of iodine can be used for coating the plate and forming the iodide of silver. It has long been a cry among most operators that it is impossible to succeed when the iodine box contains dampness. Now this is a great mistake, and we will here state that in all cases where dampness appears upon a properly prepared Daguerreotype plate, it is the result of a different temperature of the metal, from the air which surrounds it. Mr. Senter, of Auburn, was the first of our operators who used a solution of iodine for coating the plate, and we several years since saw his results, which would rival the production of any other operator. A concentrated solution of iodine is prepared by putting into a common bottle two thimblesful of hyposulphite of soda and a rather larger quantity of iodine, so that there may be more than sufficient. Add to it about 40 ounces of common water, (heated to 60 or 70 degrees,)

by little and little, moving the bottle to warm it, for fear of breaking. After shaking it a short time, the water is rapidly and strongly colored. The solution should be poured into a bottle with a ground stopper, and when cool used for iodizing.

A solution of sufficient strength can be made by moistening or just covering the iodine with water.

65. *Chloride of Iodine* (§31) *as an Accelerator.*—This is probably one of the best accelerators that can be used for coating the plate for taking views; it works too slow, however, to meet the wants of the operating room, yet its use was formerly, for a long time, adhered to by some of our best professors. In producing views with this, we are successful in obtaining well-developed impressions, with a depth of tone and richness of appearance not to be met with in the productions of any other substances. We give its use as furnished us by an old and experienced operator, and was published in *Humphrey's Journal*, vol. I, page 180:

"As the process of using chloride of iodine may be of interest to some of your subscribers, I take pleasure in giving the following manipulation: To one ounce of chloride of iodine add two ounces of water; place this mixture in a coating-box, the same as quick stuff; coat the plate with dry iodine to a light yellow, or lemon color; then bring the coating to a deep pink over the chlo-

ride. The plate must be re-coated over the dry iodine.

This combination has been very successfully used in one of our most extensive establishments in this city, and the superiority of the pictures produced by it were considered as an equivalent for the additional time required to bring out the impressions.

66. *Chlorine as an Accelerator*, §26.—We shall here refer to but a single experiment in which we employed chlorine gas for coating the plate. We were provided with a retort, the neck of which was fitted to the jar of our coating-box, through a hole drilled for its reception. This was fitted perfectly tight in our coating-box. We placed some pure undiluted bromine water, and the agents (§26) necessary for producing chlorine gas (in small quantity) in the retort. The result was that our first experiment produced an impression completely solarized in all its parts, by an exposure of four seconds of time, which would have required an exposure of twenty seconds to produce a perfectly developed impression by the usual process.

Another trial immediately produced one of the finest toned impressions we ever saw, perfectly developed in *one second of time.*

Our next two or three experiments proved total failures. We were unable to produce even a sign of an impression. By accident we broke our retort, and not being in a locality convenient to obtain

another, our experiments were necessarily suspended.

Our attention was not called to this subject again for several years, when we noticed an account of some similar experiments by F. A. P. Barnard and Dr. Wm. H. Harrington, the latter of whom is now of the firm of Dobyns & Harrington, of New Orleans.

From reading this article, we found our own difficulties explained. Too much of the chlorine gas was present in our coating jar. We would like to see some of our enterprising operators investigate this combination.

It is a singular fact, that the *vapors* of bromine and chlorine *combining* upon the iodide of silver, produce a more sensitive coating than when the two are combined in *solution*, as in chloride of bromine solution. Those having Humphrey's Journal at hand, can refer to vol. 1, p. 142.

67. *To Use Bromine Water or other Accelerator in Hot Weather.*—An excellent plan for using bromine water, is as follows:

Fill a two ounce bottle quarter full of it, and then fill the bottle with fine sand, which serves to preserve a low temperature; then place the bottle in a porous cup, same as used in the battery; fill this also with sand, and close the end with plaster of Paris. Place this in a coating-box, and it will be found to act with great uniformity and be quite permanent.

Bromide of Lime, another accelerator, can be used in the same manner, except it is only necessary when a solid sensitive is used, to mix it with the sand, without placing it in a bottle. This method is employed with great success by a few, who have regarded it as a secret worth *keeping*.

68. *A Combination, requiring the Use of only One Coating-box.*—It is often wondered by beginners, why some solution requiring only one coating cannot be employed. This can be done, but the results are not so satisfactory as when two or more are employed. Such an accelerator may be produced by adding alcoholic solution of iodine to a solution of chlorate of potash, until the latter will take up no more of the former, and to each ounce, by measure of this solution, ten drops of a saturated solution of bromide in water are added. The solution of chlorate of potash is made by diluting one part of a saturated solution of the salt with ten parts of water. The use of the chlorate is simply as a solvent of iodine.

69. *Fats as Accelerators.*—The use of fats, oils, or greasy substances, has been one of the most emphatic prohibitions about the Daguerreotype plate. Yet it has been proved that its presence in a small quantity upon the silver surface has the effect of reducing the time of exposure in the camera, from two-thirds to three-fourths. An application may be made as follows: Pour sweet oil, or rub beef or mutton fat, on a common buff, which is free from all polishing powders. With

this, buff a well-cleaned plate, and it will leave a scum, which should be mostly removed by using another buff, which should be clean. Coat the plate in the usual manner, and the result will be a great reduction in the time of exposure in the camera. The impression produced upon a plate so prepared, presents when coming from the vapor of mercury, a gray, scummy appearance, which on the application of heat in gilding, does not improve; hence its use is not generally adopted.

We have instituted some investigations upon this subject, and in the present volume, we shall not refer to it further. Those wishing to learn more fully the effect of light upon organic substances, will find Robert Hunt's "*Researches on Light*," an invaluable work.

70. *To Color Back-grounds.*---To obtain a properly-colored back-ground is a matter of no little importance to the Daguerreotype operator. We had nearly exhausted all patience, and tried the skill of painters to obtain a back-ground that would be suitable to our purpose; but all to no avail. At last we adopted the following method, and at a cost of coloring of twenty-five cents, have now in our operating department a back-ground far more valuable than those we had paid five dollars for.

Take common earth paint, such as is used in painting roofs; mix this with water to about the consistency of cream; then to four quarts of this mixture add about one pint of glue water (common glue dissolved in water, also about as thick as cream). This last will cause the paint to adhere to the cloth, to which it is applied with a common white-wash brush. By applying the brush on the coating while it is wet, it may be so blended that not a line can be seen, and a perfectly smooth color of any shade can be obtained. The shade of color we use is a light reddish-brown. Tripoli, rotten-stone, or any earthy matter, may be applied in the same manner.

71. *Transparent or Invisible Back-Ground.*---We give this as originally published by us in our *System of Photography*, 1849:

Take a large woolen blanket with long nap, the longer and rougher it is the finer will be the effect produced; stretch it on a frame of sufficient size, and suspend the frame at the center of the upper end by a string fastened to a nail in the ceiling, from three to five feet back of the sitter. Having arranged this, fasten another string to the side of the frame, and while the operation is going on in the camera, swing the back-ground from right to left, continuing this during the whole time of sitting, and you have a clear "transparent" back-ground, which throws the image out in bold relief, and renders the surface of the plate invisible. If equaled at all, it is only by atmospheric back-ground. We consider it to be the best ever known, and think it needs but to be tried to afford satisfactory proof that it is so. Although used by few before, since the first edition of this work at least two thirds of the operators have adopted its use; for any one can at once understand the principle and the effect which it produces.

We would add, at this date, that a motion imparted to any back-ground where softness is desired, produces an excellent effect.

72. *Gilding Dissolvent.*---To one quart of muriatic acid add as much sesquioxyde of iron as it will dissolve in two days. This may be done by

putting in the sesquioxyde in excess. It should be frequently shook, and when wanted for bottling it should be allowed to stand in order to settle. When this is done the solution may be poured off, and reduced by adding to it an equal quantity of water; then it is ready for use. This constitutes a gilding dissolvent now in our market.

73. *Solution for Removing Specks.*---There is probably no one cause of complaint so general as "what makes those black specks?" There are several causes which produce them, and probably the most general are dust, rouge, or a spray of moisture on the plate. If this be the case there is no solution which can remove them, as they have prevented a chemical action with the silver, and their removal would only expose the surface of the plate, which in itself would afford a contrast with the impression. Another and less dangerous source of these specks is organic matter contained in the solution employed in dissolving the chemicals, or the water in washing. Much of the hyposulphite of soda in market contains a sulphuret, which, coming in contact with the silver surface, immediately causes oxydation. Such spots, as well also as most all others found on the plate after it has been exposed in the camera, can be removed by the following solution: To one ounce of water add a piece of cyanide of potassium (§37) the size of a pea; filter the solution and apply by pouring it on the surface of the plate. In all cases the plate should first be wet

with water. Apply a gentle heat. and soon the spots will disappear, leaving the impression clear and free from all organic matter.

In the absence of cyanide of potassium, a solution of hyposulphite of soda will answer as a fair substitute.

74. *To Redeem a Solarized Impression.*---The Daguerreotype plate, prepared in the ordinary manner, should be exposed in the camera sufficient time to solarize the impression. Then, before it be exposed to the vapor of mercury, expose it for a *very brief* period to the vapor of either chlorine, bromine or iodine. Then expose over mercury, as usual. We have produced some singularly interesting results by this process.

75. *To Purify Water.*---Filter the water well, and then add about three drops of nitric acid to the pint. This can be used as absolutely pure water, but we would recommend the use of distilled water as preferable.

76. *Cleaning Mercury.*---Make a small bag of chamois skin, pour in the mercury, and squeeze it through the leather. Repeat this several times, and filter by means of a funnel made of paper, with a very small aperture, through which it will escape and leave the particles of dust, or other substances, in the paper. A paper with a pin-hole through it will answer as well, and it is less difficult to make.

77. *Adhesive Paper.*---Take gum arabic, four ounces, put it in a wide-mouthed bottle and pour on water about one-third above the gum. Add half ounce of isinglass, or fish glue, and a small piece of loaf sugar. Let all dissolve, and spread over French letter paper or bank note paper, with a brush or piece of sponge. If once spreading is not enough, perform the same operation a second time.

78. *Black Stain for Apparatus.*—Dissolve gum shellac in alcohol, or procure shellac varnish at the druggists', stir in lampblack, and apply with a sponge or bit of rag. This will adhere to metal, as well as wood, and is used for the inside of camera tubes, &c.

79. *Sealing Wax for Bottles.*—Melt together six parts rosin and one beeswax, and add a small quantity of lampblack; or, if red is preferable, add red lead. Common white wax is best, as most chemicals act less upon it.

When bottles containing bromine are to be sealed, it is well to grease the stopper. This, however, only when the bottle is in frequent use, for if it were to be sent by any conveyance it would be likely to fly out.

80. *Rouge.*—The method employed by Lord Ross is probably unsurpassed in the production of rouge. He has given his process as follows:

"I prepare the peroxide of iron by precipitation

with water of ammonia, from a pure dilute solution of sulphate of iron; the precipitate is washed, pressed in a screw press till nearly dry, and exposed to a heat which in the dark appears a dull, low red. The only points of importance are, that the sulphate of iron should be pure, that the water of ammonia should be decidedly in excess, and that the heat should not exceed that I have described. The color will be a bright crimson inclining to yellow. I have tried both potash and soda, pure, instead of water of ammonia, but after washing with some degree of care, a trace of the alkali still remained, and the peroxyde was of an ochrey color, till overheated, and did not polish properly."

Care should be observed to apply rouge in a dry state to the surface of the plate.

We would remark that so far as our experience has led us, we consider good rouge fully equal to any other polishing material for the last or finishing polishing; consequently we shall not take up our space in innumerating any of the great variety that find but few advocates.

Why Rouge is to be Preferred.—"Because it burnishes better, and because it assists in fixing the layer of gold, rendering it less susceptible of being removed in scales when heated too much."

81. *Rotten Stone.*—Purchase the best ground rotten stone of the druggist, put a few ounces at a time in a wedgewood or porcelain mortar, with plenty of clean rain water. This should have

about forty drops of nitric acid to the quart. Grind well, and after letting the mortar stand *two minutes*, pour into a third. After remaining undisturbed *eight minutes*, finally pour off into a fourth to settle. Rinse back the sediment in the second and third, and grind over with a new batch. Repeat the operation till you have all in the fourth vessel. Let this stand several hours, and pour off the water very carefully. Set the deposit in the sun, or by a stove to dry. When perfectly dry, pulverize, and it is ready for use. With a little trouble you will obtain in this way a much better article than can generally be bought of dealers. For the last washing, alcohol, or a mixture of alcohol and water, is preferable.

82. *Potassa Solution.*—The use of a solution of potassa in the preparation of the plate was suggested in the early history of the Daguerreotype. It was thought to possess some peculiar property for improving the tone of the impression. It is used for moistening the rotten stone in polishing the plate, and may be prepared by putting about an ounce and a half of alcohol in a close bottle, and add half a stick of caustic potash. This will soon become of a deep red color. For use, fill your small bottle, having a quill in the cork, with alcohol, and add a few drops of the above, or enough to change it to a bright orange or saffron color.

Hyposulphite (38) *Solution.*—This solution is

used for dissolving the chemical coating off the plate. This is performed after the plate has been exposed to the mercurial vapors. Care should be observed not to make the solution too strong. The proportion most commonly adopted is 80 grains of hyposulphite of soda to one pint of water. We refer to this more fully in another place.

84. *A Substitute for the Hyposulphite Solution.* —M. Daguerre recommends the use of a solution of salt water for removing the coating off the plate. We found this of some service at one time during our travels. Our hyposulphite bottle got broke and its contents lost, so as only to leave enough for preparing gilding. We resorted to the use of salt solution, and found it to answer well. Make a saturated solution of salt in water. First wash the plate with clear water; then immerse it in the saline solution, when it should be agitated, and the coating will soon disappear. Another process with a salt solution of half the strength of the above is very interesting and effectual. The plate having been dipped into cold water, is placed in a solution of common salt, of moderate strength; it lies without being acted upon at all; but if it be now touched on one corner with a piece of zinc, which has been scraped bright, the yellow coat of iodide moves off like a wave and disappears. It is a very pretty process. The zinc and silver forming together voltaic couple, with the salt water intervening, oxydation of the

zinc takes place, and the silver surface commences to evolve hydrogen gas; while this is in a nascent condition it decomposes the film of iodide of silver, giving rise to the production of hydriodic acid, which is very soluble in water, and hence instantly removed.

This process, therefore, differs from that with hyposulphite. The latter acts by dissolving the iodide of silver, the former by decomposing it. It is necessary not to leave the zinc in contact too long, or it deposits stains, and in large plates the contact should be made at the four corners successively, to avoid this accident.

85. *Gilding Solution.*—To one pint of pure rain or distilled water add fifteen grains of pure chloride of gold, and to another pint add sixty grains of hyposulphite of soda. When dissolved, pour the *gold solution* into the *hyposulphite* by small quantities, shaking well after each addition. The soda solution must not be poured into the gold, as the gold would be immediately decomposed, and the solution turns black, and is unfit for use.

Some operators add muriate of potash and other substances, but these do not possess any advantage except in cases where it is necessary to bleach the solarized portions of the impression, and when such is the case, chloride of sodium (common salt) is probably as effective and is the most convenient. Add about a teaspoonful to two ounces of the gilding.

86. *Solution for Increasing the Brilliancy of the Daguerreotype.*---This solution will have the effect to thoroughly cleanse the surface of the gilded plate and excite a powerful influence on the general character of the impression. To a solution of 3 ounces of water, in which is dissolved a quarter of an ounce of cyanide of potassium, (§37) add one teaspoonful of a solution containing 6 ounces of water and half an ounce of each pure carbonate of potash, alum, common salt, gallic acid, sulphate of copper and purified borax. While the plate is wet, pour on a little and heat it with a powerful blaze. The effect will be quickly produced, in from three to fifteen seconds. Rinse and dry, as in the gilding.

87. *Bleaching Solution.*---Make a saturated solution of muriate of ammonia (*sal ammoniac*) in pure water, and filter through paper. Reduce with an equal quantity of water when used. When the linen or any other portion of the impression is badly solarized, after removing the coating rinse with water; then pour this upon the surface in the same manner as the gilding solution. If the solarization be very deep, apply the lamp heneath and warm the plate a trifle. Now pour off, and without rinsing, apply the gilding. The whole operation must be quickly performed or the chlorine soon attacks the shades of the picture. When properly done, however, the solarized parts are restored to a clear, transparent white.

88. *Electro, or Cold Gilding.*—This process we have adopted, and it produces exceedingly beautiful impressions for the stereoscope, adding a great charm to the pleasing effect of that instrument. It also possesses a pretty and curious effect on views. It is easy of trial, and may be used by dissolving one gramme of chloride of gold in half a litre of ordinary water, and thirty grammes of hyposulphite of soda in another half litre of similar water; then pour the solution of chloride of gold into that of soda, by little and little, agitating it exactly as in M. Fizeau's preparation, of which there is but a variation.

When you wish to use it, pour some into a plate or any other vessel of the same kind, sufficient to cover the proof; then, after having added to it a drop of ammonia, immerse the plate in it as soon as you take it out of the mercury-box, after having wiped its back and edges, and agitate the mixture quickly from right to left, so as to dissolve rapidly the coating of iodide of silver as usual. As soon as the plate appears white, cease all rapid motion, but continue to give it a slight undulating one; for if it were allowed to remain still for only a few minutes, the proof would be clouded. By little and little, the surface of the plate takes a yellow tint, which darkens more and more, approaching to bistre. You stop, therefore, at the color you wish; and when the proof has been washed and dried, in the manner previously explained, it will be found to be fixed, without any stain, with a limpid surface, and an

extraordinary warm tone. If you were to augment the proportions of the ammonia or chloride of gold, the operation would progress much quicker, but then the middle of the proof would be always much clearer than towards the border. The mixture may be used several times without being renewed. It does not, however, give such a beautiful color to the impression as when it is newly prepared. By communicating to the vessel containing the solution a continual motion, the impression, when once immersed, will be fixed. During that time, and while attending to anything else, watch its color; and at the end of ten minutes or a quarter of an hour, take it out of the bath and dry it.

89. *Agent for Destroying Bromine, Chlorine and Iodine Vapors.*—Aqua ammonia, sprinkled about the chemical or coating room will soon neutralize all the vapor in the atmosphere of either chlorine, bromine or iodine. No operator should be without, at least, a six-ounce bottle filled with ammonia. A little of its vapor about the camera box has a decided and happy effect. Burnt coffee, pulverized, has also the property of destroying the vapors of the above chemicals, as also almost any other agent employed about the Daguerreotype room. Its deodorizing properties are such that if brought in contact with air filled with the odor of decomposing meat, it will instantly destroy all disagreeable smell. It can easily be used in the Daguerreotype room by

placing a little of the raw bean, finely pulverized, on an old plate, and roasting it over the spirit lamp.

90. *Buff Dryer.*—There are various methods for keeping buffs dry and free from dust. Some place a sheet of iron against the wall at an angle sufficient to put a lamp between it and the wall, and then let the buff rest against the top of the sheet. By this method the buff, is for its full length close to the heated iron, and at the same time exposed to the heated atmosphere and any dust that may be free. We would recommend some arrangement by which the buff would be inclosed. We have found the following to answer the purpose well, which is a box of sheet iron twenty inches long, eight wide and five high, with one end left open and the other closed; the cover is made of the same material, with the edges bent over to go on and off. There are several wires running through the center of the sides, which it is necessary to cover with cloth or paper to absorb all the moisture that may be made by applying the heat, and the buffs are put in and taken out at the open end. In order that the heat may be as nearly uniform as possible, an iron bar one inch wide, eighteen inches long and one half inch thick, is so bent that the center is one quarter inch from the bottom of the box, and that at least two inches of each end come in contact with the bottom; this being riveted on the bottom, and a lamp with a small blaze applied

to the center of the bar of iron. This will constitute one of the best and cheapest buff dryers in use. It may be suspended from the wall by placing wires around it, or it may stand upon legs. Perhaps a more convenient plan is to place it under the workbench in a similar position to a drawer. One precaution is necessary: when first heating the dryer, apply but a very gentle heat. This will prevent an accumulation of moisture, which would otherwise pass off in steam, coming in contact with the buff, thus causing a dampness. Another caution: never have the temperature of the air in the heater more than *ten* degrees above that which surrounds it.

When wheels are used, they should be encased in a sheet iron or wood case. All those made for our market are provided in this respect.

91.—*Keeping Buffs in Order.*—This is one of the most important objects to arrest the attention of the operator. Every buff is more or less liable to get out of order by dust falling upon or coming in contact with the polishing powder employed in cleaning the plate. The edge of every plate should be thoroughly wiped and freed from any material that may adhere while cleaning. We have adopted the following method, which proves highly successful:

Rub the buff leather, holding the face down, with the sharp edge of a pair of shears or a piece of glass. This brings out any portion of the skin which may have become matted from any

moisture, and also takes out any substance imbedded in it, and prevents it from scratching. Then, with a stiff brush, rub the buff well, and it will be found to work well. This same process employ on wheels and hand buffs every morning, or oftener, as occasion requires.

92. *Preparing Buffs.*—Two of these are necessary. That part of the stick to be covered should be about eighteen or twenty inches long, and three wide, and made crowning on the face from one end to the other, about one-half inch. Before covering, these are to be padded with two or three thicknesses of Canton flannel. The buff should not be too hard, but padded with flannel, so that by drawing it over the plate, it may touch across the surface. The only proper material for buffs is prepared buckskin; and if prepared in a proper manner, this needs nothing but to be tacked upon the stick. There are several varieties of wheels employed, the one most generally adopted in Lewis' Patent, which consists of several varieties of shaped wheels. Any operator can make a suitable wheel on the same plan of a turning lathe.

93. *To Clean Buckskins.*—When the operator is compelled to purchase an unprepared buckskin, the following is a good process for cleaning it: There is always in the buckskin leather that is purchased, more or less of an oily matter, which is acquired in its preparation, sometimes even

amounting to a third of its weight. The following is the mode of ridding it of this noxious ingredient: Dissolve, in about six or seven quarts of filtered water, about five ounces of potash; when dissolved, wash with the solution an ordinary buckskin; when it has been well stirred in the liquid the water becomes very soapy, owing to the combination of the potash with the oily matters contained in the skin. Throw away this solution and use some fresh water without potash, and rather tepid; change it several times until it remains quite limpid. Then gently stretch the skin to dry in an airy shaded place. When thoroughly dried, rub it well between the hands. It thus becomes very pliant and velvet-like.

94. *Reflectors for Taking Views.*---There has been an excellent camera introduced by Mr. Harrison for taking views, but the time of exposure, which is increased in proportion to the focal length, is considered an objection; consequently many adhere to the old plan of using the speculum, or, rather, substitute a mirror. We now have one we have used for several years, and find it equal to any article of the kind we have ever tried. One is easily made by a tinman, at a trifling expense. Procure a piece of best plate looking-glass, two and a half by five inches for a quarter, or four by eight for a half-sized camera; put a piece of pasteboard of the same size on the back, to protect the silvering, and stick around the edge in the same manner as in putting up a pic-

ture. Take a sheet of tin for the large size, or a half sheet for the other; place the glass cross wise in the center; bend the ends of the tin over the edge of the glass and turn them back so as to form a groove to hold the glass, and still allow it to slide out and in. These ends of the tin must be turned out flaring, that they may not reflect in the glass.

Have a tin band about an inch wide made to fit close on the end of the camera tube; place it on, and taking the tin containing the glass, bring it to an angle of forty-five degrees with the tube, extending nearly the whole length of the glass in front of the lenses; lap the loose ends of the tin on each side of the tin rim, and having your camera turned on the side to throw the view lengthwise, arrange the exact angle by examining the image on the ground-glass. When you have it exactly right, hold it while it is soldered fast to the band. Take out your glass and stain the tin black, to prevent reflection.

There has recently been introduced a new article, called by the inventor "Catham's Metalic Reflectors." They consist of a very simple arrangement, and are entitled to some consideration.

95. *Polishing the Daguerreotype Plate.*—We shall endeavor to present to the reader the process we have found productive of good and satisfactory results, presenting the same in a clear and concise manner, so that any one may, by following us through the various manipulations, be enabled to succeed. If there is any one part of the process in Daguerreotype in which operators fail more than all others, it is in not properly preparing the plate. It has truly been said that it would take a volume to describe all the methods that have been suggested for polishing the plate.

We shall confine ourselves to the following description, which has been successfully practised, also most generally adopted by our operators, and we believe equal, if not superior, to any other method, yet at the same time it is not of so much importance what particular method is employed, so that it be *thoroughly* and *skilfully* carried out.

There is a general tendency with beginners to slight this operation; hence the necessity of adopting a method which precludes the possibility of doing so. During many years study and practice in the art, we have tried numerous methods and substances for the better accomplishment of the end in view, and have finally settled upon the following, as being (so far as our experience allows

us to judge) the *modus operandi* best suited to all circumstances; under no condition would we approve of a method less rigorous or precise.

The operator being provided with a bottle of finely prepared rotten stone, cover the mouth of the bottle with a piece of thick paper, this perforated with a pin so that the rotten stone can be dusted on the plate. Fasten the plate on the holder,* take the rotten stone, (Becker's can always be depended upon,) and dust on lightly until the surface is freely covered, now drop on the plate's surface a few drops of an alchoholic solution.†

Take a patch of Canton flannel; in order to prevent the moisture from the hand it should have a thick, firm texture; with this rub the plate in circles across, then back, covering one-half of the former row of circles in each crossing until you have gone over the plate and back to the point of beginning, occupying at least half a minute in the operation, for a small plate, and so in proportion for the other sizes.

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* There are many kinds of holders in use. Peck's patent is very well liked by the operators. We have recently seen a very economical and good holder invented by Mr. Black of Boston.

† This solution is composed of equal parts of alcohol and water, for the summer, and in winter three parts alcohol to one of water; a few drops of potassa solution, §82, may be added, and is known to have a decided effect upon the plate.

Care should be observed to keep the patch wet with the alcoholic solution forming a paste on the surface of the plate, the motion of the hand should be brisk and free, not hurried, and the pressure about equal to that of a pound weight. When the cotton is disposed to adhere to the plate, and slip from under the finger, spread the fore and middle fingers a little apart, then pressing down, bring them together in such a manner as to form a fold in the cloth between them, by which means you will hold it perfectly secure.

Avoid wetting the fingers, and should they perspire, wipe them often, as the moisture penetrating the cotton and coming in contact with the plate, would cause streaks, it would be difficult to remove. We will here remark that many operators use much more cotton flannel than there is need of. We have found in our experience that a single patch about one and a half inch square will be better for cleaning a number of plates, than a new piece for every plate. This is the case for the wet, and for the dry rubbing two or three pieces will be found to answer. Thus with four or five cloths a dozen plates may be prepared.

Some operators use prepared cotton and think it more convenient than the flannel. This may be had prepared free from seeds and in a very perfect state if wished.

In going over the plate and back, great care should be observed in touching its surface as equally as possible. The greatest care should be taken neither to touch the plate with the fingers, nor

that part of the cotton flannel which is to come in contact with its surface; take a clean piece of flannel by one corner, snap it smartly to free it from dust and loose fibres, lay it face-side upward, dust on a little fine rotton stone, with this polish around, or across, or in circles, lightly and briskly, passing gradually over the whole surface of the plate, as was done before with the wet. The plate should now exhibit a bright, clear, uniform surface, with a strong metalic lustre, perfectly free from any appearance of film; if not, the last polishing should be continued until the effect is obtained, and when once obtained the plate is ready for buffing.

96. *Buffing the Plate.*---There are a variety of ways and means employed in this part of the operation. Some choose wheels, and others prefer the ordinary hand-buff. We have been unable to detect any peculiar advantage in the use of the wheel except in the facility of the operation; no doubt, however, but there is a saving of time, particularly in the preparation of the larger plates. For general use, we have not seen a wheel better adapted for this purpose than the one patented by Messrs. Lewis, §92.

It is generally well to use a hand-buff before placing the plate on the wheel; this is in order to prevent, as far as possible, the dust or other substance that may be on the surface of the plate. We will here follow out the use of the hand-buffs (two are necessary) as they are mostly used.

In the morning, before using the buffs, brush both as clean as possible, in order to free them from dust; then with the blade of shears, held perpendicular, rub the buffs from end to end; then knock them both together in order to free them from all dust or other substances, occasionally exposing them in the sun or to the fire. §91.

With one of the buffs, (reserving the finest and softest for the last operation,) powder its face with fine rouge and brush off slightly, leaving only the finest particles in it. Every operator should have two plate-holders; one for cleaning and one for buffing the plate; for using only one, the rotten stone is liable to get on the buff and scratch the plate.

Rest the fingers of the left hand on the back of the buff, near the farther end, with about the same pressure as in cleaning, while with the right you bear on the handle to correspond, and give the buff a free, easy, horizontal motion, passing it very nearly the whole length over the plate each time. Continue this operation in such a manner that the plate will on all parts of its surface have received an equal amount of polish. This buff once well filled with polish, add but little after, say a small quantity once in two or three plates. The polish as well as the buffs must be kept *perfectly dry*.

The second buff should always be in the best order, and if this is the case, but little polish after the first need be used. Much depends upon the last finish of the surface of the plate, and as a fine

impression is desired in the same ratio, the operator must exercise care and skill in this operation.

Some buff the smaller plates on the hands, by resting them on the fingers in such a manner that the buff cannot touch them; some by holding the edges with the thumb and little finger, with the remaining fingers under, or on the back; and others buff on the holder. When this last method is adopted, it requires the greatest caution to prevent the dust from getting on the buff. The holder should be wiped clean.

The plate frequently slips off or around, and the buff comes in contact with the bed of the holder. When, however, the operator is so unfortunate as to meet with this mishap, the utmost care must be observed in thoroughly cleaning the buff cover before further buffing.

In this last buffing it may be continued as before, except without the application of polish powder to the last buff. Examine the surface occasionally, and buff more lightly towards the close of the operation, using at last the mere weight of the buff. This last buffing should occupy as long time as the first.

The point to be aimed at, is, the production of a surface of such exquisite polish as to be itself invisible, like the surface of a mirror. The secret of producing pictures discernible in any light, lies in this: the more dark, deep and mirror-like the surface of the plate, the more nearly do we approach to perfection.

In all cases, very light and long-continued buff

ing is productive of the greater success, since by that means a more perfect polish can be obtained.

The question is often asked, why is it that the plates receive the coating so unevenly? We will answer by saying that it may arise from two causes: the first and most general cause is that those parts of the plates' surface which receive the heaviest coating have been more thoroughly polished, and the consequence is that it is more sensitive to the chemical operation. Second, and might perhaps be considered a part of the first, the heat of the plate may not be equal in all its parts; this may arise from the heat caused by the friction in buffing. It is a well-known *fact*, with which every observing practitioner is familiar, that a silver plate at a temperature of 45° or less, exposed to the vapors of iodine, is less sensitive and takes a longer time to coat, than when it is at a temperature of 60° or more.

Whenever a view is to be taken, or any impression which requires the plate to be turned on the side, it should be buffed in the other direction, so that the marks will *always* be horizontal, when the picture is in position. With the finest possible polish, the plate is ready for the coating-box.

The question is often asked by operators, What is the state of the plate when polished and allowed to stand for a time before using? To meet this point we have only to consider the silver and the power acting upon it. Pure atmosphere does not act upon silver; but we do not have this about our operating rooms, as it is

more or less charged with sulphurated hydrogen, which soon tarnishes the surface of the plate with a film of brown sulphurate. It is this that sometimes causes the black specks which appear on finishing the impression, and are a great annoyance. Hence we see that the plate should be buffed just before receiving the vapor of iodine. Mr. Hunt gives his opinion of the use of diluted nitric acid as the best solution for freeing the surface of the plate; he says:

"Numerous experiments on plated copper, pure silver plates, and on silvered glass and paper, have convinced me that the first operation of polishing with nitric acid, &c., is essential to the production of the *most sensitive* surface. All who will take the trouble to examine the subject will soon be convinced that the acid softens the silver, bringing it to a state in which it is extremely susceptible of being either oxydized or iodized, according as the circumstances may occur of its exposure to the atmosphere or the iodine."

We cannot see the objection to this solution; it is not, however, in general use. Our operators do not find it of sufficient importance to the success of their pictures to accept it, the alcoholic solution being in its nature less objectionable.

We will say here, that a plate submitted to only an ordinary polish is found to contain numberless minute particles of the powder made use of. Should the same plate be buffed for a *long* time, the polish will nearly all disappear, leaving the cavities in the surface free for the action of agents

employed in subsequent operation. For this reason we find that a great amount of polishing powder should not be applied to the last buff, and it is obvious that three buffs can be employed to advantage; the two last should not receive any polishing materials. We have examined a plate that was considered to possess a fine finish, and similar had produced good impressions; these same plates, when subjected to a long and light buffing, would present a surface no finer in appearance to the naked eye; but upon exposure to the solar radiation, would produce a well-defined image in *one fourth* less time than the plate without the extra buffing.

97. *Coating the Plate.*—For this purpose our mechanics and artists have provided a simple operation called a coating-box, which is so arranged as to be perfectly tight, retaining the vapor of the iodine or accelerators, and at the same time allowing by means of a slide, the exposure of the plate to these vapors. They can readily be obtained by application to any operator, all of whom can furnish them.

The principal difficulty in coating the plate, is that of preserving the exact proportion between the quantity of iodine and bromine, or quick. It is here necessary to say, that hardly any two persons see alike the same degree of color, so as to be enabled to judge correctly the exact tint, *i. e.* what one might describe as light rose red, might appear to another as bright or cherry red; conse-

quently, the only rule for the student in Daguerreotype, is to study what appears to him to be the particular tint or shade required to aid him to produce the desired result. Practice has proved that but a slight variation in the chemical coating of the Daguerreotype plate will very materially affect the final result.

The operator will proportion the coating of iodine and bromine or accelerators according to the strength and composition of the latter.

Experience proves that the common impression iodized to a *rather light yellow gold tint*, and brought by the bromine to a *very light rose color*, have their whites very intense, and their deep shades very black. It is also known that if you employ a thicker coating of iodine, and apply upon it a proportionate tint of bromine, so as to obtain a *deep rose tint*, the oppositions will be less marked, and the image have a softer tone. This effect has been obvious to every one who has practised the art. Thus we observe that the light coatings produce strong contrast of light and shade, and that this contrast grows gradually less, until in the very heavy coatings it almost wholly disappears. From this it will readily be perceived that the middle shades are the ones to be desired for representing the harmonious blending of the lights and shades.

Then, if we examine with respect to strength, or depth of tone, and sharpness of impression, we see that the light coating produces a very sharp, but shallow impression; while the other extreme

gives a deep, but very dull one. Here, then, are still better reasons for avoiding either extreme. The changes through which the plate passes in coating may be considered a *yellow* straw color or dark *orange* yellow, a *rose* color more or less dark in tint, or *red* violet, steel *blue* or *indigo*, and lastly *green*. After attaining this last named color, the plate resumes a light yellow tint, and continues to pass successively a second time, with very few exceptions, through all the shades above mentioned.

We will here present some excellent remarks upon this subject by Mr. Finley. This gentleman says:—

"It is well known to all who have given much attention to the subject, that an excess of iodine gives the light portions of objects with peculiar strength and clearness, while the darker parts are retarded, as it were, and not brought out by that length of exposure which suffices for the former. Hence statuary, monuments, and all objects of like character, were remarkably well delineated by the original process of Daguerre; the plate being coated with iodine alone. An excess of bromine to a certain degree, has the opposite effect; the white portions of the impression appearing of a dull, leaden hue, while those which should be black, or dark, appear quite light. This being the case, I conclude there must be a point between the two extremes, where light and dark objects will be in photogenic equilibrium. The great object, therefore, is to maintain, as nearly as pos-

sible, a perfect balance between the two elements entering into union to form the sensitive coating of the plate, in order that the lights and shades be truly and faithfully represented, and that all objects, whether light or dark, be made to appear so far conformable to nature, as is consistent with the difference in the photogenic energy of the different colored rays of light. It is this nicely balanced combination which insures, in the highest degree, a union of the essential qualities of a fine Daguerreotype, viz., clearness and strength, with softness and purity of tone.

"So far as I know, it is the universal practice of operators to judge of the proportion of iodine and bromine in coating the plate, by two standards of color, the one fixed upon for the iodine, the other for the additional coating of bromine. Now I maintain that these alone form a very fallacious standard. First, because the color appears to the eye either lighter or darker, according as there is more or less light by which we inspect the coating; and secondly, because if it occur that we are deceived in obtaining the exact tint for the first coating, we are worse misled in obtaining the second, for if the iodine coating be too light, then an undue proportion of bromine is used in order to bring it to the second standard, and *vice versa*."

The iodine box should be kept clean and dry. The plate immediately after the *last buffing*, should be placed over the iodine, and the coating will depend upon the character of the tone of the

impression desired. Coating over dry iodine to an orange color, then over the accelerator, §59, to a light rose, and back over iodine one sixth as long as first coating, will produce a fine, soft tone, and is the coating generally used for most accelerators. The plate iodized to a dark orange yellow, or tinged slightly with incipient rose color, coated over the accelerator to a deep rose red, then back over iodine one-tenth as long as at first coating, gives a clear, strong, bold, deep impression.

We will here state a singular fact, which is not generally known to the operator. If a plate, coated over the iodine to a rose red, and then exposed to strong dry quick or weak bromine water, so that a change of color can be seen, then recoated over the iodine twice as long as at first coating, it will be found far more sensitive when exposed to the light than when it has been recoated over the iodine one-fourth of the time of the first coating.

Probably the best accelerating combination is "Gurney's American compound," §59, or some of the combinations of bromide of lime. We have found the first to possess perhaps more uniformity in its action than any other combination we have ever used.

The plate once coated should be kept excluded from the light by means of the plate holder for the camera box.

We will notice one of the principal causes having a tendency to prevent the perfect uniformity of chemical action between the iodine and silver;

hydrogen, or the moisture in the atmosphere, makes a very perceptible barrier. This moisture may arise as the result of the cold, from a want of friction in the buffing of the plate, which, coming in contact with the warmer air, as a writer on this subject says: "It is well known that as often as bodies, when cold, are exposed to a warmer air, the humidity contained in them is condensed. It is to this effect that we must attribute the difficulty experienced in operating in most cases." This is corroborated by the results experienced by our operators. So it is seen that the plate should be of a temperature above that of the atmosphere. Mr. Gurney submits his plates to a gentle heat from a spirit lamp just before exposing them to the vapor of iodine. Our experience has convinced us that a plate heated to about 80° before being exposed to iodine will present a far better *defined* image than a plate at a temperature of 50°. We account for this by noticing that, at the higher temperature, the plate throws off any *larger crystals* that might otherwise be deposited, receiving only the *finer*, thus producing a more perfect chemical *combination* of iodide of silver. We would call the attention of the operator to this point, as presenting something of interest, and may direct in a way of accelerating the future operations.

That the presence of a film of moisture over the plate is a preventative of a uniform chemical action, may be readily understood from the fact that iodine is almost insoluble in water, requiring

seven thousand parts of water to dissolve *one* of iodine, or one grain to a gallon of water. Yet its affinities for silver and other substances are so powerful as to prevent its existing in an insulated state, hence we can account for the frequent occurrence of a plate presenting parts of an image over its surface. It is quite evident that those parts of the plate's surface covered with moisture are nothing like as sensitive to the iodine as those parts perfectly free.

98. *Exposure of the plate in the Camera, and Position.*—The time of exposure necessary to produce an image upon the Daguerreotype plate, can only be determined by experiment, and requires a liberality of judgment to be exercised on the part of the operator. The constant variation of the light renders it impossible to lay down any exact rule upon this point. Light is not alone to be considered, the amount of coating exercises a deviating influence, also the subjects to be represented are not equally photogenic, some requiring much longer time of exposure than others. This may be easily observed by exposing the plate at the same time to a plaster bust and a piece of black velvet, the first being a much stronger reflector of light than the latter: the time necessary to produce a well developed image of the velvet being about six times longer than that required to produce an equally defined image of plaster. The manner of judging correctly of the time is by the appearance of the impression after it has

been developed by the mercurial vapors. Should it present a deep blue or black appearance it is solarized or over-timed. This sometimes is to an extent, that a perfect negative is formed, the white being represented black, and the dark light.

An object requiring the particular care and attention of the operator is the proper focus. It is not unfrequently the complaint of sitters that their hands are represented as being magnified and greatly out of proportion with the general figure. This the case also with the nose and eyes, but in a less degree. As this cannot be wholly remedied, it is desirous to come as near as possible, and in order to do this, it is necessary to present the figure in such a position as to bring it as nearly as posible upon the same plane, by making all parts nearly at equal distance from the lenses. This must be done by the sitter inclining the head and bust formed to a natural, easy position, and placing the hands closely to the body, thus preserving a proper proportion, and giving a lively familiarity to the general impression. It is not an uncommon fault among our less experienced operators to give a front view of the face of nearly every individual regardless of any particular form, and this is often insisted upon by the sitter,* who

* We might here picture some curious scenes experienced by our operators. Every one is familiar with a certain class of our community whose ideas of the importance of a free and easy position of the body are too closely confined with stays, attention to toilet, tightly fitting dress coats and the like, to admit of being represented

seems to think the truth of the picture exists principally in the eyes staring the beholder full in the face.

Nothing, in many instances, can be more out of place in a Daguerreotype portrait than this, for let a man with a thin, long, defeated-politician-face, be represented by a directly front view, we have, to all appearances, increased the width of the face to such an extent as to reveal it flat and broad, losing the characteristic point by which it would be the most readily recognized. The method we should adopt in taking the likeness of such an individual as above, would be to turn the face from the camera, so as to present the end of the nose and the prominence of the cheek bone equally distant from the lenses, and then focussing on the corner of the eye towards the nose, we cannot in many cases, fail to produce an image with the lips, chin, hair, eyes and forehead in the minutest possible definition.

It should be the study of every operator to notice the effect of the lights and shades while arranging the sitter, and at the same time be very particular to give ease in the position.

No matter how successful the chemical effect may have been, should the image appear stiff and

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as if nature had endowed them with the power of flexibility. To such we would suggest the following, to be well learned and retained in the mind while presenting themselves before the Daguerreotype camera :

" The experience of one who has often been Daguerreotyped, is, to let the operator have his own way."

monument-like, all is lost. "In the master-piece, grace and elegance must be combined."

We will here use the words of another, which are very true:

"So great is the difference in many faces, when inspected in opposite directions, that one of the two views, however accurately taken, would not communicate the likeness—it not being the usually observed characteristic form. When the right view of the head is obtained, it is first necessary to consider the size of the plate it is to be taken on so as to form an idea of the *proportion the head should bear to it.* The mind must arrange these points before we commence, or we shall find everything too large or too small for the happy proportion of the picture, and the conveying of a just notion of the stature. The work will have to be done over, and time sacrificed, if this is not attended to. The adjustment of the head to the size of the plate (as seen from the margin of the mat), is not to be taught: every one must bring himself, by scrutinizing practice, to mathematical accuracy; for something will be discovered in every face *which can be surmounted only by experience.*

"The eye nearest the camera, in a three-quarter-face, is placed in the middle of the breadth of the plate; the chin, in a person of middle stature, in the *middle of the length,* and *higher* according to the *proportional height* of the person."

In regard to the proper elevation of the camera, we would here state that we have found it best

in taking portraits where the hands are introduced, to place the camera at about equal height with the eyes of the sitter, in order to bring the face and hands equi-distant from the tube. It will be found, if the above be followed, that by attaching a string to the camera tube, and making a semi-circle, that the face and hands of the sitter will occupy a corresponding distance, and the consequence is that the impression will appear without the hands being magnified.

We have found that a person with a freckly face can have as fine, fair, and clear an impression as the most perfect complexion: this may be done by the subject rubbing the face until it is *very red.* The effect is to lessen the contrast, and the photogenic intensity of the red and yellow being nearly the same, an impression can be produced *perfectly* clear.

When a child is to be taken, and there are doubts of its keeping still, the operation may be accelerated by placing it nearer the window, bringing the screen nearer, and placing a white muslin cloth over the head; this will enable you to work in one third of the usual time. Should the person move, or the plate become exposed to the light, it may be restored to its original sensitiveness by placing it over the quick, one or two seconds.

99. *Developing the Daguerreotype.*—After the plate has been submitted to the operation of the light, the image is still invisible. It requires to be

exposed to the vapors of heated mercury. It is not absolutely necessary to apply artificial heat to the mercury to develop the image, for we have produced fair proofs by placing a plate over the bath at the ordinary temperature of the atmosphere. This plan, however, requires a long time and cannot be adopted in practice, even if it were advisable. The time more usually required in developing the image over the mercural vapors, is about two minutes, and the temperature is raised to a point necessary to produce the desired effect in that time. This point varies as indicated by different scales, but for the ordinary scales it is not far from 90° cen.

The mercury bath is accompanied with a centergrade thermometer, by which we regulate the heat. Those furnished by the manufacturers are not always correct, and it requires some experience to find the proper degree on the scale.

We would here remark that it is advisable when placing the spirit lamp under the bath to so arrange it that the position of applied heat should always be upon the same point : viz., should the heat be directly under the bulb containing the thermometer it would raise the mercury in the tube to the point marked, and the temperature of that in the bath, would be far below what it should be, hence it is (where time is followed for developing) that many failures occur. This is observed more readily in large baths made of thick iron, particularly upon first heating. We in practice apply the heat as nearly as possible between the centre

of the bottom of the bath and the bulb containing the mercury tube. It is advisable to keep the lamp lighted under the bath from the time of coming in the morning to the close of business at night. By this means we have a uniformity of action, that cannot be otherwise obtained.

It is well known to the experienced Daguerreotypist, that different atmosphere, has a decided effect upon the mercury in developing the Daguerreotype. It will require a greater degree of heat for one atmosphere than for another. Experience alone determines this little difference.

In summer, on cloudy and stormy days, mercurial vapors rise more readily and quickly than in the temperature of autumn or winter. From 60 degrees upwards towards the boiling point, (660°) the vapors of mercury rise in greater abundance and collect in larger globules on cold surfaces.

For various reasons, we prefer a high temperature and short exposure. It accelerates the process. It renders the lights of the picture more strong and clear, while the deep shades are more intense. It gives a finer lustre to the drapery. The solarized portions also are very seldom blue, especially after gilding. If heated too high, however, the light parts become of a dead, chalky white, and the shadows are injured by numerous little globules of mercury, deposited over them. Just the right quantity of mercury leaves the impression of a transparent, pearly white tone, which improves in the highest degree in gilding. To merculiarize with exactness is a nice doint. If

there is reason to suspect having timed rather short in the camera, reduce the time over mercury in a corresponding proportion. A dark impression will be ruined by the quantity of mercury which would only improve a light one.

If practicable, it is most expedient that the plate be submitted to the action of mercury immediately on coming from the camera. We frequently, however, carry plates for miles in the plate-holders, and after exposing in the camera, bring them back to expose to mercury, and obtain fair proofs; but for the reason before given, it is advisable to carry along the bath, and bring out the impression on the spot.

It is sometimes the practice of inexperienced operators to take the plate off the bath and examine the impression by solar light. This plan should be abandoned, as it is almost sure to produce a dense blue film over the shadows. This we are led to believe is occasioned by the action of light on the yet sensitive portions of the plate, and made to appear only by subsequent exposure to mercury, being equivalent to solarization.

There has been little said by our professors upon the subject of the position of the plates while exposed to the mercurial vapor. M. Hunt in referring to this subject, says:—Daguerre himself laid much stess upon the necessity of exposing the plate to the mercury at an angle of about 45°. This, perhaps, is the most convenient position as it enables the operator to view the plate distinctly, and watch the development of the design; but beyond this,

I am satisfied there exists no real necessity for angular position. Both horizontally and vertically, I have often produced equally effective Daguerreotypes." We presume from the last sentence of Mr. Hunt, that he has confined his experiments to the smaller sized plates. Hence he may not have thought of the effect of the vertical exposure of a large plate,

In America this is a subject of no little importance. When an impression is to be developed upon a plate *fifteen* by *seventeen* inches, were we to use an angle of about 45°, it would be found to make a perceptible difference in the appearance of the image. By examining the wood tops of our baths as formerly made, it will be found that there is a great variation in the distance from the mercury to the different portions of the plate. By measurement of one of these tops for the size plate above mentioned, we find the distance to the nearest point between the mercury and the plate, to be *thirteen*, the middle point *sixteen*, and the fartherest point *twenty-one and a half inches:* by this we see that one point of the plate is *eight and a half* inches farther from the mercury than the nearest point, even this is not the variation that would necessarily be, were we to adopt the angle of 54° as urged by Daguerre.

Among our principal professors the bevel top will not be found in use where the large plates are used. Should any one feel desirous to test more minutely the effect produced by a bevel top bath, we would suggest to them to place a frame, so

constructed as to hold *three sixth* size plates, and fit it to the top of a large bath, and so arrange it with openings that the plates may be placed, one at the nearest point to the mercury, the second midway, and the third to the greatest distance, and by placing the plates over at one and the same time, the experimenter will be enabled to judge if there exists a difference in the developing. We, in speaking of the above, refer to baths, of the *ordinary heights* used by operators.

We will now proceed to examine the effect produced by mercurial vapor upon the plate at different lengths of exposure. In some investigations by us upon the appearance of the Daguerreotype impressions when developed over mercury at 90° C. (184° F.), the following was the result. Plates coated and exposed to light in our usual manner of operating produced on exposure of

1-2 minute, whole impression deep blue.

1 minute, ashy and flat; no shadows, linen deep blue.

1 1-2 minute, coarse and spongy;—shadows muddy—drapery dirty reddish brown.

2 minutes, shallow or watery; shadows yellowish—drapery brown.

2 1-4 minutes, soft;—face scarcely white, shadows neutral, drapery fine dark brown linen somewhat blue.

2 1-2 minutes, clear and pearly; shadows clear and positive, of a purple tint, drapery jet black, with the dark shades slightly frosted with mercury.

2 3-4 to 3 minutes, hard and chalky;—shadows

harsh, drapery roughened, and misty with excess of mercury.

The foregoing results will be found general.

There are numerous opinions among our operators in regard to the quantity of mercury necessary for a bath. As regards this we need only say similar results occur when two pounds or two *ounces* are used, but the quantity we generally employ is about a quarter of a pound. We are of the opinion that one ounce will answer as well as a larger quantity. We know of no better proof in favor of a small quantity than that presented in the following incident. Several years since an operator of our acquaintance was requested to go several miles to take a Daguerreotype portrait of a deceased person. He packed up his apparatus and proceeded over a rough road for some distance to the house where he was to take the portrait, and arranging his paraphernalia, with all the expedition which the occasion required, after having every thing in usual order (as was supposed), he proceeded and took some ten or twelve *very superior* impressions. They were fine, clear, and well *developed*. After taking the number ordered, he proceeded to re-pack his apparatus, and to his surprise when he took up the bottle he carried the mercury in, he found it still filled, and *none in the bath*, except, only such particles as had adhered to the sides, after dusting and being jolted for several miles over the rough road. From this it will be seen that a very little mercury will suffice to develop fine proofs. We saw some of the impressions referred to above,

and they were certainly well developed, and were superior specimens of our art.

100. *Removing the Coating.*—After the impression has been developed over the mercurial vapor, the next step is to remove the sensitive coating; for this purpose the solution described in §82 is used. It is best that the washing be done immediately on the plate coming from the mercury bath. If allowed to stand long with the coating on, it assumes a very dark tint—as the operation of the light continues, though less active, than while exposed in the camera, and destroys that brightness which would otherwise have been obtained. It is preferable to wash and gild a picture without its first being dried; yet when there are doubts of its giving satisfaction, there would sometimes be a saving by drying and getting the decision of the subject before gilding, as this last injures the plate for another impression. First, light your spirit lamp, then with your pliers take the plate by the lower right hand corner, holding it in such a manner that the pliers will form in a line with the upper left hand corner; pour on, slowly, the hyposulphite solution, slightly agitating the plate, until all the coating is dissolved off; then rinse off with clean water, and if it is not to be gilded, dry by holding the plate perpendicular with the bottom left hand corner lowest, and applying the blaze of the spirit lamp to the back, at the same time blowing gently downward on the face of the plate.

The hyposulphite solution should be often filtered through a sponge, and it will answer for a great number of washings. Yet it is observed that the mercury collects in this solution in small globules, which come in contact with the plate, causing white spots, which spoil the impression. These should be guarded against, and the solution renewed. Again, in order to prevent streaks or scum on the surface of the plate, it is necessary that the coating should be removed with a good degree of uniformity. We find in our practice that the hyposulphite of soda in our market varies much as regards strength, and consequently the rule to be adopted is to make a solution of sufficient strength to remove the coating in about ten seconds. We are aware that it may be said that this strong solution would have a tendency to injure the impression by destroying in a measure the sharpness of outline. To meet this, we need only say that the preventative is, to not let the solution rest on the surface of the plate for a longer time than is absolutely necessary, and then it should be drenched copiously with water; hence a chemical action upon the image is prevented and the general operation facilitated. This plan is adopted by our first operators with the greatest success.

If the operator should allow the hyposulphite solution to run over the plate unevenly, it is quite likely that white or blue streaks would result. These it is impossible to remove without injury to the impression. Some, in order to prevent

this, breathe over the surface, thus moistening it and putting it in a condition to receive the solution with greater uniformity. The plate should be well washed with water before gilding.

101. *Gilding, or Fixing the Image.*—The next process we are to give is that for fixing the image on the plate. This is done by precipitating a thin film of gold over the surface. This is productive of the most brilliant effect when prepared immediately after the plate has been washed with water after the application of the hyposulphite solution, and before the plate has been allowed to dry. When, however, the plate has been dried and allowed to stand for any time, before gilding, the hyposulphite wash should be applied as at first, in order to destroy any chemical coating that may have been formed on exposure of the plate to the air. For gilding the larger plates, we have a gilding stand so constructed that the plate can be put on a perfect level. We, in practice, prefer holding the plate in nippers, fastened at on corner. Hold the plate in same manner as in §100; pour on the gilding, newly filtered, until the surface is wholly covered, and with the blaze of the spirit lamp, at least three inches high, apply it to the back of the plate, moving it about, that the surface may be heated with as much uniformity as possible. Continuing this operation, the surface will generally become covered with small yellow bubbles which soon disappear, leaving the image clear and distinct.

It is advisable to make use of a lamp of a sufficiently strong flame to produce the effect in a few minutes. If, after a first heating, it is found that the impression can admit of a greater degree of intensity, it might be heated anew; but that is seldom necessary, and often by trying to do too well, the operator, if he persists in heating certain parts of the plate, may find the liquid dry up just above the flame, and inevitably cause a stain*; or else the blacks are covered with a film, or even the coating of gold may suddenly exfoliate, when small particles are detached from the plate. The impression is then entirely spoiled, but the plate may be re-polished.

It is not unfrequent that the surface assumes a dark, cloudy appearance. This is generally the best sign that the gilding will bring out the impression with the greatest degree of distinctness. Soon, the clouds gradually begin to disappear, and "like a thing of life" stands forth the image, clothed with all the brilliancy and clearness that the combined efforts of nature and art can produce. When in the operator's judgment t he operation has arrived at the highest state of perfection, rinse suddenly, with an abundance of clean water, and dry as before described.

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* This can be remedied, however, if it is immediately washed over with the same solution that is on the plate, so that the surface shall not become cool; continue for a short time to apply the lamp under, and agitate the plate slightly, and it will soon be free from all imperfections and give a fine clear tone.

When an impression is dark, the gilding process may be longer continued; but when light, it should be gilded quickly, as lengthening the time tends to bleach the impression and make it too white. The cause of this appears to be, that with a moderate heat the chlorine is merely set free from the gold, and remaining in the solution, instead of being driven off, with its powerful bleaching properties, it immediately acts upon the shades of the picture. A dark impression can thus, by a low heat, long-continued, be made quite light. To procure the best effect, then, heat suddenly wish a large blaze, and, judging it to be at the maximum, cool as suddenly as possible.

When the hyposulphite of gold is used instead of the chloride, a less heat should be employed.

102. *Coloring Daguerreotypes.*—Of all the so-called improvements in the Daguerreotype, the coloring is the least worthy of notice. Yet the operator is often, in fact most generally, called upon to hide an excellent specimen under *paint.* We can conceive of nothing more perfect in a Daguerreotype than a finely-developed image, with clearness of lights and shadows, possessing the lively tone resulting from good gilding. Such pictures, however, are not always had, and then color may perform the part of hiding the imperfections. We present the following method as given in *Willat's Manual:*

"Daguerreotype portraits are now commonly met with beautifully colored; but the coloring is

a process requiring great care and judgment, and many good pictures are spoiled in fruitless experiments. Several different methods of coloring have been proposed. The simplest mode appears to be that of using dry colors prepared in the following manner: A little of the color required, very finely ground, is thrown into a glass containing water, in which a few grains of gum arabac have been dissolved. After standing a few moments, the mixture may be passed through bibulous paper, and the residue perfectly dried for use. The principal colors used are Carmine, Chrome Yellow, Burnt Sienna, Ultra-marine and White; boxes fitted with sets of colors properly prepared, may be obtained of the dealers, and include Carmine, White, Lilac, Sky Blue, Pink, Yellow, Flesh color, Orange, Brown, Purple, Light Green, Dark Green and Blue. With a few colors, however, all the rest may be made thus: Orange, by Yellow and Red; Purple, with Blue and Red; Green, Blue and Yellow; Brown, with Umber, Carmine and Lamp Black; Scarlet, Carmine and Light Red. While it is true that a little color may relieve the dark metalic look of some Daguerreotypes, it must not be concealed that the covering of the fine delicate outline and exquisite gradations of tone of a good picture with such a coating, is barbarous and inartistic.

"The prevailing taste is, however, decidedly for colored proofs, and the following directions will assist the amateur in ministering to this perverted taste, should he be so inclined. The co-

loring should commence with the face, and the flesh tint must be stippled on (not rubbed) with a small camel's-hair brush, beginning from the center of the cheek, taking great care not to go over the outline of the face, and also not to have too much color in the brush; the eyes and eyebrows must not be touched with color. After the flesh color is applied, take a piece of very soft cotton and pass it very gently backwards and forwards over the face, so as to soften down the color, and then apply the carmine to give the required tint. For men, the darker tints should predominate, and for women the warmer. Very light hair may be improved by a slight tint of brown or yellow, and brown according to the color. In coloring the drapery, the same care must be used. No rules can be laid down for all the different colors required, and the amateur had better obtain the assistance or advice of some one accustomed to the use of colors. A little white with a dash of blue, or a little silver, will improve white linen, lace, &c. The jewelery may be touched with gold or silver from the shells, moistened with distilled water, and laid on with a fine-pointed sable-hair brush."

Brilliants may be represented by picking the plate with the point of a pin or knife.

103. *Coloring Back-Grounds.*—This process, for a long time practised in Europe, has just created an excitement among our operators. It was introduced several years since by M. Leotard de

Seuze, and is easily prepared as follows: To one quart of *distilled water* add two grains of Russian glue (*ichthyocolla*); boil this until all the glue is dissolved; filter well through common filtering paper or fine linen, when it is ready for use. As no one would be likely to want the above quantity, the same proportions may be preserved in less quantities.

Take the common colors, and pulverize or grind them while moistened with spirits of turpentine, then let them dry, which will soon take place, by the co-operation of the turpentine, and when dry again pulverize, when they will be ready for use.

To Use.—Pour on the gilded impression, a little of the above solution, enough to cover the plate, then pour off and dry by applying a very *gentle heat.* The plate is now covered with a transparent membrane, or vegetable paper, which is susceptible of receiving the color with a remarkable degree of fineness, not to be otherwise obtained. The colors are applied by using common water color brushes, such as accompany the small boxes of color to be found in any book store. With care and judgment this coloring can be applied with the greatest uniformity. After the desired quantity of color is on the plate it may be well dusted with our common dust brush, and then another coating with the same solution applied in the same manner as above.

We insert this process under the head of *coloring back-grounds.* This we have done as it is mostly used for that purpose, but by no means

confined to that portion of the Daguerreotype, but may be applied to any part of the impression.

104. *Securing Dagaerreotypes.*—For the better safety of the Daguerreotype it is usually sealed by putting the plate, glass and mat, or diaphragm together by means of adhesive paper, §77. This prevents in a measure the atmosphere from operating readily upon the surface of the plate. When the picture is sealed it is ready for a case or frame.

105. *To make Plates for the Daguerreotype.*—We do not give the method employed by our regular plate manufacturers; this is not important, as the operator could not possibly profit by it from the fact of the great expense of manufacturing. The following will be found practical:

Procure a well planished copper plate of the required size, and well polish it, first with pumice stone and water, then with snake stone, jewelers' rouge. Plates can be purchased in a high state of preparation from the engravers. Having prepared the copper-plate, well rub it with salt and water, and then with the silvering powder. No kind answers better than that used by clock-makers to silver their dial-plates. It is composed of one part of well-washed chloride of silver, five parts of cream of tartar, and four parts of table salt. This powder must be kept in a dark vessel, and in a dry place. For a plate six inches by five, as much of this composition as can be taken up on a shilling is sufficient. It is to be laid in the centre of the

copper, and the figures being wetted, to be quickly rubbed over every part of the plate, adding occasionally a little damp salt. The copper being covered with the silvering is to be speedily well washed in water, in which a little soda is dissolved, and as soon as the surface is of a fine silvery whiteness, it is to be dried with a very clean warm cloth. In this state the plates may be kept for use. The first process is to expose the plate to the heat of a spirit flame, until the silvered surface becomes of a well-defined golden-yellow color; then when the plate is cold, take a piece of cotton, dipped in very dilute nitric acid, and rub lightly over it until the white hue is restored, and dry it with very soft clean cloths. A weak solution of the hydriodate of potash, in which a small portion of iodine is dissolved, is now passed over the plate with a wide camel's hair brush. The silver is thus converted, over its surface, into an ioduret of silver; and in this state it is exposed to light, which blackens it. When dry, it is to be again polished, either with dilute acid or a solution of carbonate of soda, and afterwards with dry cotton, and the smallest possible portion of prepared chalk: by this means a surface of the highest polish is produced. The *rationale* of this process is, in the first place, the heat applied dry off any adhering acid, and effects more perfect union between the copper and silver, so as to enable it to bear the subsequent processes. The first yellow surface appears to be an oxide of silver with, possibly, a minute quantity of cop-

per in combination, which being removed leave a surface chemically pure.

Another Method.—The best and simplest mode with which we are acquainted is to divide an earthenware vessel with a diaphragm : one side should be filled with a very dilute solution of sulphuric acid, and the other with either a solution of ferroprussiate of potash, or muriate of soda, saturated with chloride of silver. The copper plate, varnished on one side, is united, by means of a copper wire, with a plate of zinc. The zinc plate being immersed in the acid, and the copper in the salt, a weak electric current is generated, which precipitates the silver in a very uniform manner over the entire surface.

Another Method.—A piece of brass or of polished copper, brass is preferred, is perfectly planished and its surface made perfectly clean. A solution of nitrate of silver, so weak that the silver is precipitated slowly, and a brownish color, on the brass, is laid uniformly over it, "at least three times," with a camel's hair pencil. After each application of the nitrate, the plate should be rubbed gently in one direction, with moistened bytartrate of potassa, applied with buff. This coat of silver receives a fine polish from peroxide of iron and buff. Proofs are said to have been taken on it, comparable with those obtained on French plates.

106. *M. Soliel's Process for determining the time of exposure in the Camera.*—M. Soliel has

proposed the use of the chloride of silver to determine the time required to produce a good impression on the iodated plate in the camera. His method is to fix at the bottom of a tube, blackened within, a piece of card, on which chloride of silver, mixed with gum or dextrine, is spread. The tube thus disposed is turned from the side of the object of which we wish to take the image, and the time that the chloride of silver takes to become of a grayish slate color will be the time required for the light of the camera to produce a good effect on the iocated silver.

107. *Instantaneous Process for procuring Daguerreotypes.*—The following method of producing Daguerreotypes has by some been named as above. Most experienced operators have been long acquainted with the effect of the vapor of ammonia upon the chemically coated plate. We will here insert Mr. W. H. Hewett's plan of proceeding. This gentleman in referring to it, (published in 1845,) says:

"This improvement consists in using the vapor of ammonia, as an object to accelerate the action of light upon the plate. The effect is produced upon a simple iodized plate, but still more upon a plate prepared in the ordinary way, with both iodine and bromine. By this means, the author obtained impressions instantaneously in the sunshine, and in five to ten seconds in a moderate light; and he hopes to be able to take moving objects. It can be applied by exposing the prepared

plate over a surface of water, to which a few drops of ammonia have been added, (sufficient to make it smell of ammonia ;) or the vapor can be introduced into the camera during the action. In fact, the presence of ammonia, in the operating-room, appears to have a good effect, as it also neutralizes the vapors of iodine and bromine that may be floating about, and which are so detrimental to the influences of light upon the plate."

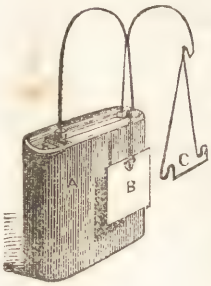
108. *Galvanizing the Daguerreotype Plate.*— In consideration of the importance of galvanized plates we shall endeavor to give as plain and concise a manner of manipulation as possible. For some time it was a question among the operators generally, as to the beneficial result of Electro-typing the Daguerreotype Plate, but for a few years past our first operators have found it a fact, that a well electro-silvered surface is the best for producing a portrait by the Daguerreotype.

From our own experiments, we have found that a French or Scovill Plate, by being galvanized, can be rendered more sensitive to the operation of the light in proportion of *one* to *five*, *viz.*, if a plate as furnished by the market, be cleaned, polished, coated and exposed in the Camera, if the required time to freely develop an impression be ten seconds, a similar plate prepared in like manner and galvanized will produce an equally well-defined image in eight seconds. In connection with this subject, there is one fact worthy of notice ; a plate with a very *heavy* coating of pure silver, *will not*

produce an equally developed image, as a plate with a thinner coating, hence the *thin* coating provided it entirely covers the surface, is the *best*, and is the one most to be desired. The experiment is plain and simple. Let the slate receive a heavy or thick coating by the electrotype, then polish, coat, expose in the usual manner, and the result will be a flat, ashy, indistinct impression; when, on the other hand, the thin coating will produce a bright, clear and distinct image, with all the details delineated.

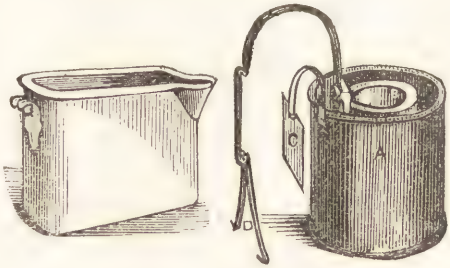
The style of battery best for the purpose has been, and now is, a question of dispute among operators; some preferring the Daniell battery to Smee's. Some claim the superiority of the first from its uniformity of action; others, of the latter, for its strength. We consider either good, and for the inexperienced would prefer *the Daniell*. This is more simple in its construction, while it has certainty in action. The more skillful electrotyper would prefer Smee's, and this is the one most generally in use. We would remark that the plan of galvanizing plates should be followed by every operator, and when once thoroughly tested, no one will abandon it. We will now proceed to describe the two batteries, Smee's and Daniell's; also, the manner of using them.

Fig. 1 represents Smee's battery. A may be a glass or earthen jar. B is a piece of silver attached to the connecting wire from one of the poles. C is another wire with a small bent hook to hold the plate. These two poles are immersed in the earthen dish, Fig. 2, which contains the silvering solutions.



1.

Thus the connection is perfect, and the operation is carried on. *Daniell's battery*, although not as simple as Smee's, is by many preferred. This battery is represented in Fig. 3.



2. 3.

A is an outer copper cylinder. B, zinc contained in a porous cup. C, a piece of silver attached to the copper by means of a copper wire. D is for the same purpose as C. in Fig. 1.

Smee's battery may be charged by putting into it sulphuric acid, diluted with water, in proportion of one part acid to ten (by measure) of water.

This same solution will answer to put in the porous cup used in Daniell's battery, Fig. 2. Nitric acid is perhaps preferable when the battery is used about the operating room, as it gives off less fumes. The copper cylinder in Daniell's battery should contain a saturated solution of sulphate of copper. This solution may be kept of equal strength by adding an excess of the sulphate of copper.

109. *Silvery Solution.*—With a battery prepared as in §107, and a solution in the plate cup, Fig. 2, prepared as follows, the operator will be prepared for coating the plate:

To any desired quantity of chloride of silver, §36, in water add, little by little, *cyanide of potassium*,, shaking well at each addition, until all the cyanide is dissolved. Continue this operation, and add the cyanide, until all of the precipitate is taken up and held in solution.

This solution is now ready for the plaet-cup, Fig. 2. Enough water may be added to cover any sized plate when held *perpendicular* in the cup. The strength of the solution may be kept up by occasionally adding the chloride of silver and cyanide of potassium. There should always be a very little excess of the cyanide.

The plate should be well cleaned and buffed, and the solution well stirred before it is immersed. Care should be observed to keep the solution clean, aud allow no particle of dust to come in contact with the surface of the plate. The plate is now to be attached to the pole of the battery.

After remaining a short time, it assumes a blue color; take it out, rinse freely with pure water, then dry with a spirit lamp, and it is ready for buffing. Buff and coat in the usual manner. Some operators are in the practice of immersing the plate in the solution and buffing twice. This additional silvering is no improvement wherever there has been a proper first coating.

Sometimes the operator is troubled with streaks or scum on the plate. This may arise from three causes, all of which experience must teach the experimenter to avoid; *first*, too great an excess of cyanide in the solution; *second*, a lack of silver; *third*, the current too strong. Another annoyance arises from the solution being dirty and the dirt collecting on the surface. When this is the case, the dirt is sure to come in contact with the surface of the plate as it is plunged into the solution, and the result is a scum that it is difficult to dispose of. This can be prevented only by frequent filtering. One thing should always be borne in mind in electrotyping Daguerreotype plates—that, in order to secure a *perfectly coated surface*, the plate should be *perfectly* cleaned. In this point, many who have tried the electrotype process have failed, attributing their ill success to other than the proper cause.

110. *Daguerreotypes without Mercury.*—The following process possesses some interest, and is worthy a trial from operators. M. Natterer, of Vienna, discovered a process for obtaining proofs

on iodized plates with the chloride of sulphur, without the use of mercury. A plate of silver is iodized in the usual manner, and then placed on the top of a vessel six or eight inches high, having at the bottom, in a small cup, a few drops of chloride of sulphur; it should remain exposed to the action of the vapor until the sombre yellow color is changed to a red, after which it is brought to a focus in the camera, where it is exposed to the light in the camera, for about the time necessary to produce an ordinary Daguerreotype. The plate is then taken out and examined in the camera by the light of a candle. It often occurs that no trace of the image is as yet perceptible, but if the plate is heated by placing over a spirit lamp the unprepared side, or if left for some time in the dark, or, lastly, if exposed only a few seconds to a weak, dimmed light, the positive picture then appears with all its shades. Of these three modes of bringing out the image, the second is superior to the others.

111. *Management of Chemicals.*—It is necessary, first of all, to know that you have a chemical which is capable of producing good results when in skilful hands. For this reason it is best to prepare your own quick, after some formula which is known to be good. Those quick-stuffs which contain chloride of iodine are noted for their depth of tone, while they probably operate with less uniformity than those which are destitute of it. For operating under ordinary circum-

stances, especially with an inferior light, probably no accelerator is more quick and sure than Wolcott's. It also produces a very fine, white, pleasing picture, though lacking that depth of impression so much to be desired. The dry quick operates with surety, and its use is simple and easy, producing an impression much like Wolcott's. For those having a good and permanent light, however, we would recommend a chemical giving more body to the impression.

There is a class of accelerators called sensitives, claiming to work in from three to ten seconds, which, however, will be found very little, if any, more sensitive than this. We frequently work it with the ordinary coating in twelve and fifteen seconds. The manner in which the sensitives are worked is by coating very light. In this way, a flat, shallow picture is obtained in a few seconds; and the same can be done with any of the more volatile quicks.

It is a fact not generally known, that a plate coated in a light chemical room is more sensitive than when coated in darkness. By admitting a free, uniform light, and exposing the plate to it a few seconds after coating, then timing short in the camera, a very light, clear impression is obtained. The time in the camera is reduced in proportion to the previous action of light. The shades of course are destroyed, and the tone injured; still, for taking children, we have succeeded better by this method than by the use of "sensitives." The discovery of this principle was

accidental, while operating where the direct rays of the sun, entering the window just before sunset, fell on the curtain of our dark room, rendering it very light within.

The selection of iodine is not unimportant. Reject, at once, that which has anything like a dull, black, greasy appearance; and select that which is in beautiful large crystaline scales, of a purple color, and brilliant steel lustre.

Solarization, and general blueness of all the light parts of the picture, were formerly great obstacles to success, though now scarcely thought of by first-class artists. Beginners in the art, however, are still apt to meet with this difficulty. It is occasioned by dampness in the iodine box, which causes the plate to become coated with a hydro-iodide of silver, instead of the iodide. The remedy is in drying your iodine. If in summer, you can open your box and set in sunshine a few minutes; or if in winter, set it under a stove a short time. The true method, however, is to dry it by means of the chloride of calcium. It has such a remarkable affinity for water, that a small fragment placed in the open air, even in the dryest weather, soon becomes dissolved.

Take one or two ounces of this chemical, heat it in the drying bath, or in a hot stove, to perfect dryness; place it in a small glass toy dish, or large watch crystal, and set it in the center of your iodine box. Take this out and heat to dryness every morning. Adopt this process, and with your mercury at a high temperature, you will never be troubled with blue pictures.

Young operators are apt to impute all want of success in operating, to their chemicals, even though the cause is quite as likely to be elsewhere. Failure is quite likely to occur from dampness in the buffs, or in the polish; it is therefore necessary to be constantly on the guard in this quarter. With a view to this, always scrape your buffs with a dull knife, or with one blade of your shears, the first thing in the morning, and after brushing them thoroughly, dry them, either in the sun, by a stove, or in the buff-dryer. It is equally important that the polish and the brush should be kept dry.

Want of success may arise from vapors of iodine or bromine in the camera box, mercury bath, or even in the buffs. It is incredible how small a quantity of these vapors will affect the effect of light when coming in contact with the plate, after or during the exposure in the camera. It is therefore necessary to be cautious not to mix chemicals, nor open your boxes or bottles in your room, but take them out to do it. Never hurry the operation through from lack of confidence in the result. The fact of anything being out of order, forms no excuse for slighting the process. If unsuccessful, do not pursue the same course every trial, but vary with a view to detect the cause of the difficulty.

In case of a long series of failures, institute a regular course of investigation, after this manner, commencing where the trouble is most likely to occur:

1. Are the plates well cleaned?

2. Is the iodine dry? If the impressions come out blue, you may rest assured it is not. Take out the iodine, wipe and dry the box, and dry the calcium.

3. Is the quick battery of the right strength? If dry, it must change the plate in from six to fifteen seconds. If any of the chloride of iodine class, it may vary from five seconds to a minute. Begin by coating light, and increase on each trial, observing the effect. If the light side of the picture seems loth to come out, and shows no contrast with the dark side, it is to be inferred that your battery is too strong, and must be reduced with water or set out in the open air for a few minutes, with the lid off. If working an old battery, never renew very strong, or it will work dark and heavy. A battery, to work well, should be gradually *losing strength*, but never gaining. An old battery, however, may be quickened up and made to work well for some time, by adding five or six drops of sulphuric acid, repeating the quantity as often as necessary, providing always that acid be not used in manufacturing the quick.

4. Have the plates lost their sensitiveness by being many times exposed to mercury? Clean and burn them; but if French plates, burn light or you spoil them.

5. Are the buffs dry and clean? Examine the plate critically after buffing to detect any appearance of scum or film on the surface. If so, the

longer you buff the more it shows. Scrape and dry the buffs thoroughly.

6. Is the mercury free from scum and dirt? If not, filter. Is it also far enough from the coating boxes? Should be at least three feet, and kept covered.

7. Is the mercury sufficiently heated? This is important. Long exposure, however, will answer the same purpose.

8. Are your lenses clean, and in proper place?

9. Are the tablets in focus with the ground-glass? If you can attribute the failure to none of these, mix a new box of some other kind of quick, say the dry for instance. If you fail in the same manner here, take time, wash your buffs, overhaul all the chemicals, and start anew. Do not be discouraged. There is no day so dark but that the sun will shine again. We will close with this brief summary of advice:

Clean your plates.

Keep every thing dry.

Keep the mercury hot.

Follow these instructions carefully and you *must* succeed.

112. *Hints and Cautions.*—First of all, cleanliness should be observed. When there is dust or dirt about your room, particularly about the work-bench, failures will be frequent; for the smallest particles of *rotten-stone*, when allowed to come in contact with the buffs, will produce scratches on the surface of the plate, which very

much injures the operation, and often causes failures.

Dust flying about the room is injurious, if allowed to fall on the plate, either before or after it has been coated, as it causes black spots which cannot be removed.

The polished plate should not be allowed to come in contact with a strong current of air, for it tends to oxidize the surface. Breathing on the surface should also be avoided, for the same reason.

The plate should, in all cases, be buffed immediately before using, and not allowed to stand any length of time. It should be held with the polished face downward.

It is always best that the plate should be of the same temperature of the atmosphere in the room.

Keep the *camera* and *mercury-bath* perfectly free from the vapors of *iodine* and *bromine;* for the presence of the slightest degree of either of the above, will injure the impression in no small degree. As a preventive, let the camera be exposed to the sun or fire for a few minutes in the morning.

Filter your mercury often, to keep the surface free from film and dust.

The hyposulphite solution should be filtered through sponge every time it is used.

The direct rays of light must not enter the camera in conjunction with those reflected from the object; or the picture will be veiled, and the color of the plate changed to a thick green.

If the plate be iodized only to a light-yellow, the result might be of a bluish or gray tinge; and this is generally the case, when the quick is new and strong, and there is an excess of it on the plate, and yet not enough to form the bromide iodide of silver; in which case it would wholly spoil the impression.

Your iodine will be found to operate more successfully, when the time required for coating the plate does not fall short of fifteen seconds, or exceed one minute.

Too quick coating can be avoided by using less iodine in your box. In the summer months, when the weather is 80° and over, one-quarter of an ounce, or even less, will work to advantage.

113. *Electropying.*—We are indebted to Mr. J.H. Fitzgibbons, for the following process, which he employed in producing the excellent specimens now on exhibition at the Crystal Palace:

"I shall endeavor to lay down in as comprehensive a manner as possible the method by which I have been enabled to produce the most satisfactory results. I use a Smee's battery (another kind will do). After filling the cell, of common size, nearly full with water; add about quarter of an ounce of sulphuric acid. Mix this well, and let it stand for about three hours, or until the action of the battery becomes weak, when it is in order to work with a very uniform action. Put one pound of sulphate of copper in one quart of water; stir it until the sulphate of copper is all dis

solved, and then add one half ounce of sulpuric acid and quarter of an ounce of nitric acid. This solution well mixed should be filtered, and it is ready for use. It is very important that this solution should be kept clean, clear, and free from all foreign substance. The above quantity of this solution will be found sufficient for electrotyping a dozen of the sixth-size plates. When it is required to be strengthened it is only necessary to add a little of the sulphate of copper.

"With the battery prepared as above, and the solution of sulphate of copper in a vessel of proper dimensions to receive your plate, connect the galvanic current, and immerse the impressioned plate, letting it remain until a thin film of copper has been formed, then the battery can be strengthened, and the impression will be of sufficient thickness to be removed in from eight to twelve hours. An old Daguerreotype plate attached to the opposite pole of the battery (copper-side toward the face of the plate to be electrotyped,) will answer the same purpose as the silver-plate in §108.

"The great difficulty in taking an electrotype impression, and preserving the original, has been attributed to the battery being too powerful. I am led to believe from practice that the principal difficulty has been in the Daguerreotype plate itself, for if we use an impression that has been taken but a few days, and taken in the usual way, we will find it difficult to succeed without spoiling

both the copy and original, and so also with an old impression.

"I have found the most certain method to be as follows: Coat the Daguerreotype plate as usual, except use less of the accelerators, the proportion of iodine coating being greater, of course the time of exposure in the camera will be lengthened. Mercuralize it at about a temperature requiring to develop the image, from *six* to *eight* minutes, at least. Gilding the Daguerreotype has much to do towards producing a good electrotype copy. This should be done by applying a little heat, and gilding very slow, giving a coating of gold with the greatest possible uniformity. By this method I have been enabled to produce any number of proofs. I have produced a dozen from one impression, and it remains as perfect as when first taken.

"By a little judgment and care the operator will be enabled to produce the electrotype copy of the Daguerreotype plate without any difficulty. The electrotype copy should be immediately put under a glass and sealed in the same manner as the ordinary Daguerreotype."

114. *Crayon Daguerreotypes.*—This process patented in the United States, by J. A. Whipple, of Boston, and of course no *honorable* person will use it for his own benefit without purchasing a right.

A white back-ground is generally employed, and the object being to blur the lower portion of the plate, leaving the head of the subject in

relief.. Every Daguerreotypist is familiar with the fact that a motion of any body, between the camera and the sitter will cause a 'blur.' Cut a piece of thin paper and scallop it, making a semicircle. This is kept straight by means of a wire frame, and it is to be moved in front of the lower part of the body of the sitter during the time of exposure of the plate in the camera. Develop over mercury as usual, and the result will be a Crayon Daguerreotype.

Another method is to have a wheel with a hole cut through it of a diameter of about 12 inches. This hole is so cut as to leave teeth resembling those of a large saw. This wheel is so arranged that it can be turned around, which should be done during the time of exposure in the camera. It must be placed between the camera and the sitter, and at such a distance from the camera as to allow such proportion of the body of the sitter be seen upon the ground-glass as is desired. It will be readily seen that by turning this wheel during the operation will produce the same result as the paper being moved in the other method. The teeth make the "blur." The side of the wheel towards the camera may be *black*, by which means the result will be a dark instead of a light border.

115. *Illuminated Daguerreotypes.*—This process is also patented, and the remarks in §114, will apply in this case. The plate is prepared and exposed as in the usual method of the Daguerreo-

type. A white back-ground is employed. Let the head of the sitter come in the middle of the plate and before exposing it to the vapors of mercury, put a small mat or diaphragm, having a small hole through it, over it directly on the surface of the plate. This diaphragm should be beveled, and the bevel should be towards the surface of the plate ; this in order to prevent too sharp a line, on the impression. It will be readily seen that if an impressioned plate so covered is placed over the mercury, it will be developed on such portion only as are exposed. The principle is so familiar that further explanations are unnecessary.

116. *Natural Colors in Heliography.*—This subject is at present creating some little interest, and is worthy the attention of every operator. The following process is so plain and easy of trial that any Daguerreotypist can try it. This is as given by Mr. James Campbell, and was published in *Humphrey's Journal* of the Daguerreotype and Photographic Arts, vol. 5, page 11. Mr. Campbell has done much to further the process announced by M. Neipce, and his experiments have proved highly successful. Mr. Hill has announced that he has a process for producing impressions, representing all the colors of nature. With his process no one is acquainted, and it remains his secret, although the results which he has exhibited are said to be truly excellent. Mr. Hill was the first to announce to the world that he had discovered such a process.

The following, referred to above, is submitted as worthy of trial ·

"The proper preparation of the chloridated plate to enable it to receive colored impressions, is an object of the first importance to those wishing to experiment on it, and consequently requires particular notice. The plate may be prepared by making it the positive pole of a battery, and letting it at the same time be immersed in chlorine water. The negative pole should be a slip of platinum. All the colors may be produced from a plate so prepared if the chlorine and water are in the right proportions; but generally one color or the other predominates, according to the amount of chlorine in the liquid. By adding the chlorides of strontian, uranium, potassium, sodium, iron, or copper to the liquid, various effects may be produced, and these bodies will be found to produce the same color on the plate that their flame gives to alcohol.

The honor of this discovery is due to M. Niepce. Copper gives a variegated flame; hence many colors may be impressed on a plate prepared with a solution of its chloride.

M. Niepce recommends a solution of the mixed chlorides of copper and iron, and it is with these, that I have been most successful. As the chlorides of copper and iron are not much used in the arts, they are not generally found for sale in the shops; and it may be well to furnish those not much versed in chemistry with an easy method of preparing them.

They may be made directly from either metal

by dissolving it in hydrochloric acid; but they may be formed by a cheaper method, and by which also the acid fumes are avoided.

Sulphate of iron or copper, or both together, may be dissolved in water and then neutralized with common crude potash, or its carbonate or bicarbonate—known commonly as pearlash and saleratus. If either of the latter be used, there will be formed sulphate of potash and a carbonate of the metal used, and there will also be a considerable effervescence of carbonic acid, which will, if care is not taken, cause the mixture to run over the vessel. After the copper or iron salt is neutralized, which is known by its ceasing to effervesce, the carbonate of the metal will settle slowly, and will at first nearly fill the vessel. The supernatant fluid, which is sulphate of potash in solution, may now be carefully poured off, and its place filled with water; this operation should be repeated several times, until the water which passes off is tasteless. The carbonate of the metal rapidly changes to an oxide by contact with the air, and it will generally be found, when it is sufficiently washed, that it is at least half oxide. On adding hydrochloric acid cautiously to the mixture, a chloric of the metal will be formed, and carbonic acid will be evolved from the remaining carbonate. The chloride formed is soluble; but as they are two chlorides of these metals, and we wish to produce the one which contains the most chlorine, it is best to add the acid cautiously until the solution is decidedly

acid. After filtering, the solution it is fit for use; and it should be preserved in well stoppered bottles. The water used should be rain or distilled water.

About one part of the mixed chlorides should be used to three or four of water.

The battery may be either Smee's, Daniell's, or Grove's; if of either of the former, it should be of two series; if of the latter, one cup is sufficient.

The plate, on being immersed in the liquid, almost instantly takes a violet color. It should be allowed to remain from two to five minutes, according to the strength of the battery, and until it becomes nearly black. It should now be carefully washed, and afterwards heated over a spirit lamp until it takes a cherry-red color, and it is then ready for exposure in the camera. Before speaking of exposing the plate, it may be well to speak of some difficulties which the inexperienced operator may find in preparing it. If the battery is not in good order, and a sufficient current is not passed through the solution, the plate will become coated—and apparently almost as well as when the battery is working well—but on exposure it will give a negative picture, and but little colored; while if the battery is in good order, the impression is invariably positive.

Sometimes on heating the plate after washing, the surface is covered with spots, or assumes a variegated appearance. This indicates that the solution is impure, or that the plates have not been thoroughly washed, and are still contaminat-

ed with the soluble chlorides which are containde in the solution.

From the fact that the plate if prepared with positive electricity gives a positive picture, while if prepared otherwise it gives a negative, it is evident that electricity plays an important part in this process. The same is true to some extent with the compounds formed with iodine, bromine and fluorine.

On heating the plate, the brown coating of chloride melts into a translucent enamel, and the heat should be withdrawn when a cherry-red color is produced. If the heat is continued longer, the plate assumes a lighter color, and becomes less sensitive; and the enamel will finally scale off. To produce a picture by the ordinary process of M. Niepce, unaccelerated, it should be exposed for from three to five hours to sunlight in the camera, though pictures may be procured by contact, in from fifteen to thirty minutes.

117. *Multiplying Daguerreotypes on one Plate.* —We have produced some interesting specimens of the Daguerreotypic art, by exposing in the camera, only a portion of the sensitive plate to the action of light. When on the exposed portion an image is formed, then taking the tablet into the dark room, change ends and expose the sen sitive portion, and produce another image, developing as usual. This plan is adopted for taking likenesses for lockets. Two images can be presented as sitting side by side, by covering half the

plate with black paper, and exposing as before. In this manner we have been enabled to surprise persons by exhibiting their portrait on the same plate with a stranger's. Daguerreotypists must be cautious in practicing this, as it might not be agreeable to the parties whose likenesses are together, by the above process. It is impossible to produce an impression without a line being seen where the edge of the paper prevented the operation of the light.

We have recently seen a fine specimen produced by another plan, which far exceeds the above, there being no line, or any peculiarity denoting two exposures. The specimen referred to, was a gentleman represented on one plate by two full length portraits. This was produced by using a *black velvet* for the back-ground. The plate was exposed sufficient time to produce one impression, and then the gentleman assumed another position, and is repeated as looking at himself. From the fact that the time required to develop black-velvet being so much longer than that for producing a portrait, we are enabled to produce the above interesting results.

*COMPARATIVE TABLE OF ENGLISH AND FRENCH WEIGHTS AND MEASURES.

	Grains.
1 Pound Avoirdupoise	7000
1 Ounce ditto	437.5
1 Pound Troy	5760
1 Ounce ditto	480

Gramme	15.4063
Decigramme	1.5406
Centigramme	0.1540
Milligramme	0.0154

	Inches.
Yard	36
Metre	39-37079
Decimetre	3.93708
Centimetre	0.39370
Millimetre	0.03937

	Cubic Inches.	Grains of Distilled Water.
Imperial gallon	277.274	70000
Ditto Pint	34.65925	8750
Ditto Ounce	1.7329625	437.5
Cubic Inch	1	252.458
Litre	61.02525	15406.312
Decilitre	6.10252	1540.631

* These Tables are copied from Faraday's Chemical Manipulation.

NOTE.—In our credits on the Preface page, we observed too late, (to rectify it,) that our reference to Robert Hunt, to whom we are indebted for some of our selections had been over-looked. We cannot allow this to pass, as Mr. Hunt has proved himself one of the most valuable experimental men that has ever assumed a pen in contributing to the advancement of the Daguerreotype. No Daguerreotype operator or amateur should be found without a copy of his "*Researches on Light*," and "*Manual of Photography*." This last has just appeared. His works have won for him the esteem of every Daguereotypist in America.

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